Elastic and Non-Elastic Narrow Fabrics

By SAMUEL BROWN

and a Chapter on Narrow Fabrics Made on Knitting Machines

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Chapter I.

Growth of Webbing Business—Attempts to Substitute Cut Products for Individually Woven Webs Made on Gang Looms—Loom Setting to Reduce Vibration—Capacity of Looms and Explanation of the Various Motions That Are Employed

When we think of the discovery of rubber vulcanization and the effect it has had on world affairs our minds naturally turn to the big things, such as the automobile industry with its millions of rubber tires in constant use. These may crowd from our notice a thousand and one smaller things of importance. It is difficult to fully realize how many comforts and conveniences we derive from rubber and not the least among them is the multiplicity of woven fabrics which are used both for comfort and convenience in a variety of ways and for innumerable purposes. It is not only in such things as garters and suspenders, with which our minds may first associate elastic webs, that these fabrics are used, but they find employment in a variety of other products, which are growing more numerous all the time. Today there are in operation thousands of looms and braiders, in which many millions of dollars are invested and in the operation of which, together with complementary machinery, about ten thousand people are employed.

It was about the year 1840 when the idea of weaving threads of elastic in connection with other materials was first conceived. After long experiments this was accomplished in the very simplest form of weaving. New ideas were from time to time introduced, and new uses found for the product, until now it covers a large variety of both plain and fancy weaves, and the multiplicity of uses are so varied that few realize them who are not closely associated with the business.

American Industry Started About 1860

It was not until about the year 1860 that elastic web weaving was introduced into this country, although for a number of years previous England and Germany, and also France in a small way, had found here a market for their product, particularly in cords, braids and shoe goring, which at that particular time was fast growing in popularity. About 1860, a few looms which had been used, were brought over from England and located at Easthampton, Mass., and the manufacture of shoe goring commenced. The rubber thread required was for some time imported from England. The business grew rapidly, and factories were established in a number of cities, more particularly at Boston, Lowell and Brockton, Mass. Bridgeport, Conn., and Camden, N. J. An unfortunate labor dispute took place about the year 1890, which developed into a long-drawn out strike, ultimately precipitating friction between the shoe trade and the goring web manufacturers, which finally ended in a positive boycott of this product from which the trade has never recovered. Most of the looms which were up to this time devoted to shoe goring have been remodeled and are now used in the making of other types of elastic fabrics. In passing, it may be interesting to note that some of the looms originally brought from England 60 years ago are still in operation and doing excellent work along other lines.

Attempts to Use Wide Looms

Attempts have been made from time to time to weave elastics on wide looms, the cloth being divided at intervals by open spaces in the warps at the front reed, at either side of which spaces binding threads were woven in. These narrow strips were spaced in the front reed according to the different widths which might be required, and could easily be changed to meet the varying requirements by redrawing a few threads, inasmuch as the whole weave was uniform throughout the full width of the cloth. Between these spaces, but at a point away from the weaving line, were arranged stationary knives by which the cloth was cut into the requisite widths while it was being woven, and as it gradually passed by the knife edges. These knives were so arranged that they could be adjusted to new positions when it became necessary to change the widths of the individual strips.

While this method was more economical than weaving individual webs in gang looms, the labor cost being much less, the narrow webs produced having the cut selvages lacked the finished appearance which the individually woven webs had. And sometimes the binding threads would give way, so that the fabrics were not well received by the trade, and ultimately the demand for them died out.

Attempts were made to supersede the individually woven strips in another direction by the use of two finely woven pieces of cloth, one to form the back, and the other to form the face of the goods, with an elastic substance mechanically stretched out and inserted between the two. These different parts were calendered together and afterward cut into strips of the desired widths. This method was not without many advantages. Strips of different widths were easily made without the costly method of redrawing the warps in the looms. An unlimited choice of both plain and fancy fabrics could be used, having if desired distinctly different appearances and constructions for face and back, and this alone opened up a wide range of possibilities. The finished cloth lent itself admirably to fancy embossing and printing and to various other forms of elaboration. But somehow the trade did not take to it, and this also finally died out.

The trade ultimately settled down to the weaving of elastic goods of all kinds, both plains and fancies, in gang looms, and the business has steadily grown ever since along these lines.

Straight Shuttle and Circular Shuttle Looms

The looms employed are very varied, inasmuch as the requirements cover a wide range and new uses are constantly arising with new demands. The simplest form of weaving is that employed on the making of webs such as are mostly used for garters, and which are also used for many other simple purposes in nearly every household. These webs are commonly known as loom webs, lisles and cables. They are generally made on plain, narrow, cam looms, some of which are capable of accommodating as many as 56 pieces or strips at one time.

There are two distinct types of loom employed, one of which is known as the straight shuttle and the other the circular shuttle loom. In the former type, the straight shuttle, in traveling across the different spaces, takes up more room than the circular shuttle, and thus somewhat curtails the number of pieces which can be operated in the loom, limiting capacity of production, and relatively increasing the cost. Very few of the straight shuttle looms accommodate more than 36 shuttles, according to the width of the goods required. The circular shuttles travel over a segment of a circle and cross over each other's tracks in their movement through the shed, as shown in Fig. 1. This permits the crowding of the pieces of web

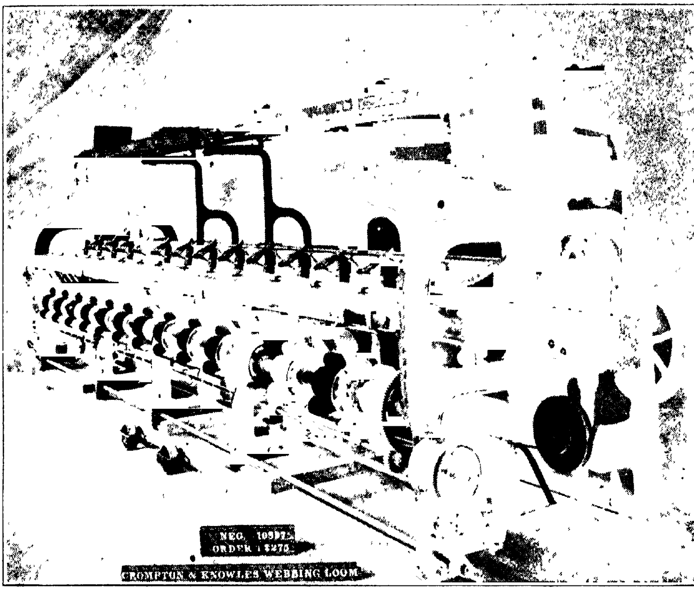
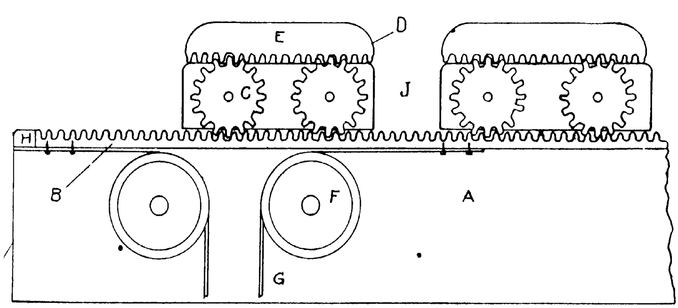


Fig. 1.—Circular Shuttle Webbing Loom



A - LAY BED
B - LAY RACK
C - PINION
D - SHUTTLE RACK
E - SHUTTLE
F - DRIVING PULLEY
G - DRIVING STRAPS
H - RUBBER CUSHION
J - WEB SPACE

Fig. 2.—Rack and Pinion Movement for Actuating Shuttles

closer together, so that many more can be accommodated in the same loom space than when the straight shuttle is used. This type sometimes runs as high as 56 shuttles to the loom.

Prevent Loom Vibration

These looms often are speeded as high as 180 picks per minute. To operate at this speed with so many pieces of web and make satisfactory goods, free from thick and thin places through irregularities of speed or variable momentum in running, a very heavy type of loom is necessary. They should be erected on solid foundations so as to eliminate all possible vibration. A solid concrete floor into which timbers have been properly set so that the feet of the looms may be securely anchored into them is the ideal way, but where this is not practicable at least heavy foundation timbers for anchoring the loom feet to should be arranged. The frames of the looms should be heavy; also the main driving shaft, which should have wide bearings so as to prolong the life of the shaft at the wearing points and obviate loose play in the boxes.

The crankshafts must also be very heavy and there should be enough of them so as to rigidly withstand the repeated beat of the lay without liability to take on any loose motion, which would be fatal to the production of perfect goods. Weight and strength here is very essential, inasmuch as it is not practical to get a direct line from the shaft to the lay on account of the harness movement, and they must be built to drop below the harnesses which form makes them subject to heavy strain at the beat of the lay. They should also be made adjustable, each arm having a heavy left and right threaded insert, so that the length of the weaving line may be changed to meet the varying requirements of different webs. They should also be constructed so that any wear may be taken up.

The lay itself must necessarily be very heavy. It is generally constructed of several thicknesses of timber of different kinds, so as to avoid any possibility of warping and shrinkage. The shuttles used are mostly made of applewood. While they must run smooth and be free from the risk of slivers they must at the same time be very light so as to be freely drawn across the multiple of web spaces. It will be easily seen that the drawing of so many shuttles over a space of about three times their length, at possibly 180 picks per minute, carrying and delivering the necessary weft to the webs, each thread of weft being checked to a certain extent by friction springs, requires great care and thought in construction. Shuttle wood must be thoroughly seasoned by age or it will not serve the purpose.

The shuttles themselves are very ingeniously constructed so as to accommodate the greatest possible amount of filling, together with the necessary space for springs to properly manipulate the tensions. Each shuttle is bored through at either side so as to allow for the insertion of a fine recoil spring, which is made fast at one end of the drilled hole at the back of the shuttle. To the other end of the spring is attached a small porcelain eye, through which is threaded the weft, making it possible to govern and take up by the action of the spring the loose filling which is thrown off as the shuttle passes and repasses through the shed. These side recoil springs are not only useful for the taking up of the loose filling but allow for a variety of threading up methods, so as to assist in the governing of the tension of the weft at one or both sides of the web, and thus afford a means of weaving the goods level. They aid in correcting any tendency to long and short sided goods, of which we will say more later.

At the back of the quill or shuttle spool is arranged another spring

on which is swivelled a porcelain device which presses against the quill, and can be so regulated as to govern the tension. This spring is so tempered that the most delicate adjustment of tension can be made.

Rack and Pinion Movement

The shuttles across the entire width of the loom are drawn to and fro by what is known as the rack and pinion movement. (See Fig. 2). This method has pretty generally superseded the old-time plan of rise and fall pegs. The rack runs back and forth in a slot grooved in the top of the lay bed, A, the entire length of the loom. To the rack is attached leather straps G, or heavily woven fabric straps, with which the rack B is pulled to and fro at each pick of the loom. The rack is of wood, having rounded teeth spaced approximately one-third of an inch apart. Into the rack are meshed pinions C, two to carry each shuttle E, the teeth of which are correspondingly spaced. The rack is set into a wood carrier which is about one inch deep and one inch wide, and the full length of the lay. The pinions are made of either raw hide or paper fibre, and these pinions again mesh into a series of racks D, grooved in on the under side of each shuttle, and thus drive the shuttle to and fro across the web spaces J.

The constant travel of the driving rack running in the groove at the top of the lay bed necessarily produces more or less wear at the bottom of the rack. It therefore is advisable to place underneath this rack a false bottom of wood of about ¼-inch thick, which after becoming worn by constant use and contact with the ever-moving rack may be easily taken out and replaced by a new one, thus keeping the rack and pinions and shuttles at all times in proper mesh with each other.

The rack is drawn backwards and forwards by the before-mentioned straps, which are passed over pulleys and are either fastened to the rack by means of wood screws, or securely locked with a metal clamp designed for this purpose. These straps are sometimes separated by a pair of cams set on a shaft making one revolution to each two picks of the loom. The power from these cams is first communicated to eccentrically-shaped wood pulleys, moving backwards and forwards, which are so formed as to start and stop the shuttles slowly, and to operate them at a higher rate of speed during their passage through the middle of the shed. This movement is necessary to avoid a too early entrance of the shuttle into the weaving shed before the harness is properly settled, and also to soften the hammering at the close of its travel so as to reduce the wear and tear.

It might be well to note here also that this hammering is also softened by the placing of a piece of soft rubber H at each end of the rack run, so that the rack strikes this soft cushion each time it goes home. While the cam method has been extensively used to produce the kind of movement most desirable for the travel of the shuttle, it has its drawback in the momentum produced, which it is often found difficult to control.

The Crompton & Knowles Loom Works have designed a shuttle motion which effectively governs the desired speeds in the travel of the shuttles while they are entering, passing through, and leaving the shed, by a dwelling movement operated by a series of gear wheels and oscillating slotted rocker. It is absolutely positive in action and does away with the uncontrollable and erratic movement so often met with in the cam drive

Movement of Harnesses

Four-pick cams are all that are necessary to produce the plain webs which are used for ordinary purposes. However, it is not the practice to confine looms to the limitations of this capacity, but to put in either 8 or

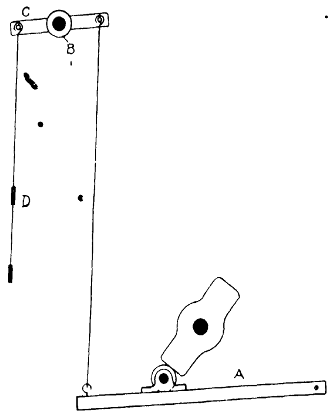


Fig. 3.—Direct Cam Movement

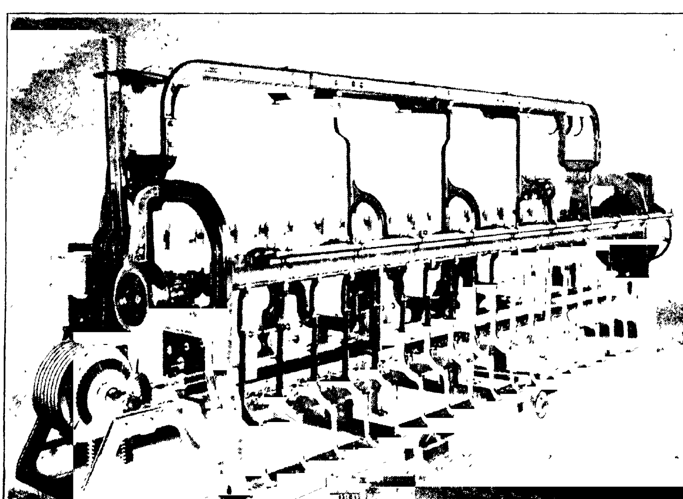


Fig. 4.—Loom with Side Cam Method of Harness Control

12-pick cams. These, besides providing means to make the plain weave, open up possibilities for a number of other weaves and combinations of weaves, which add materially to the usefulness of the loom.

There are two distinct types of cam movements used in looms of this character for the making of ordinary webs. One is known as the direct cam drive, where the cams are fitted on a 4 to 1 shaft, as shown in Fig. 3, which runs lengthwise of the loom and from which the power is communicated to the harnesses through a series of levers A, rocking poles B, levers C, and lifting wires to the harness D.

The other movement is known as the end-cam method, where a small shaft is set at the end of the loom, running at right angles to the driving shaft (See Fig. 4) from which it is driven by bevel gears. On this short shaft are set the cams, usually 8 or 12 in number, which have a series of grooves at their center so as to afford means of timing them in different positions on a feather key which runs the full length of the shaft. These cams operate what is known as the cam jacks, which may also be seen in Fig. 4.

The jacks are hung at the middle and are moved backwards and forwards by the cams, communicating movement to the various harnesses. The harnesses are connected at both the top and bottom of the jacks. This connection at both ends of the jacks makes it possible to run the looms at a very high rate of speed, as there are no weights or springs to contend with, which limits speed.

While the first described method of direct cams has some advantages over the end cams, such looms are not nearly so economical to operate as the end cams on account of the limited speed attainable. While the harnesses are lifted by means of the cams they have to be pulled down by weights or springs. The means of shed adjustment, however, enables the attaining of a well graded shed. Furthermore, the cams themselves can be so set on the shaft as to afford means of timing the movements of the different harnesses so that excellent and easy shedding results may be obtained. But the one great disadvantage is the limitation of the weaves attainable, which limitation is largely overcome by the end-cam method.

When the direct cam movement is used, and where the goods being woven are of such a character as to demand a very slow speed of the loom, it is practicable to bring the harnesses down by weighting them with wide flat weights of the requisite size. But where higher speed is required than is advisable for weighted harnesses, springs are more desirable.

The simplest form of pulling down the harnesses is by the use of floor blocks and direct springs. There is, however, a disadvantage in using the direct spring on account of the pull increasing until the extreme lift of the harness is reached, which necessarily increases materially the power expended in operating same and makes an unnecessary strain. The better way is to use what is known as spring jacks, which have an easier pull than the direct spring inasmuch as the load eases off on the pull, diminishing from the greatest pull at the start to the lightest pull at the extreme lift on the lever, so that the load is uniformly distributed all through the movement and less power is employed.

CHAPTER II.

Looms Should Be Adapted to Make a Wide Variety of Goods—Take-Up and Let-Off Motions—Making the Rubber Warps for Different Classes of Web—Importance of Uniform Tension—Defects from Uneven Tension and Chafing of Threads

THE greatest care is necessary in planning out the details of the harness. On account of the great length it becomes necessary that everything possible be done to avoid any chance of warping or sagging, for the least irregularity which may be developed will of course interfere with the evenness of the shed. The harness frames must be made of the very best stock obtainable, thoroughly seasoned, and absolutely straight grained. Each frame must be supported at regular and frequent intervals by stays or supports mortised in the runners. These stays are slotted at top and bottom to receive the heddle bars and keep them accurately in line, and thus prevent them from catching on the neighboring harness during the operation of the shedding process.

It is necessary also that the top and bottom heddle bars be accurately spaced so as to allow proper freedom for the heddles to ride easily on the bars, and thus avoid any binding of heddles which would have a tendency to crowd the warp stock together and prevent clearance of the shed. Steel heddles are preferable to ones that bend and twist more or less and get out of alignment. They are made from tempered steel which is very flexible and they have round cornerless eyes that cannot possibly catch or chafe the warp threads. They adjust themselves automatically to the frame and cannot twist or bend while at work, and are made to accommodate themselves to every conceivable kind of goods.

INSTALL LOOMS FOR WIDE RANGE

In installing looms for narrow elastic fabrics it is advisable to make ample provision for creeling the warps necessary for the different fabrics which may from time to time be required. In the manufacture of the light single cloth garter webs, not more than two warps to the piece are required, a face warp and a gut warp, and the temptation to save a little in the initial cost possibly may suggest a limitation of creel spaces to immediate requirements. Added expense may seem for the time being an unnecessary burden. But very soon there may arise a call for other goods which cannot be made within the limitations of the two bank creel; therefore changes become necessary which are generally much heavier than first cost would have been.

Nothing less than a five bank creel should be installed Many times the availability of six banks has solved knotty problems of warp division to care for the various weaves and materials employed in some constructions. If the entire capacity of the larger creel is not required when first starting it will not be necessary to clothe all of it with levers, buttons, etc., which may be procured later. But by all means ample provision should be made for the full frame work and supporting rods for same.

TAKE-UP MOTION

Another important consideration is to make proper provision for a reliable take-up motion, so that the goods may be taken away from the reed while weaving without any liability to variableness. This liability was present in many of the earlier looms and exists in some of the mills

today. The old time fine ratchet gear, even when provided with a number of pawls, is always liable to erratic picking, which alone will ruin an otherwise perfect piece of goods and materially change the cost of manufacturing. A slight irregularity of picking may not be discernible in non-elastic goods, which will be satisfactory so long as the variableness is not easily seen and a reasonable average of picks per inch is maintained. But in elastic goods, where the contraction takes place after they leave the press rolls, every irregularity is revealed and intensified so there is no room to take chances. The only safe way is to employ picking gears making one tooth to each pick of the loom, and then to change the gears when different picking becomes necessary.

In many of the existing looms there has been no adequate provision made for the weaver to let the web back to the reed mechanically when a joining becomes necessary through the breaking of the filling while weaving, or where a quill may have run off unnoticed. It is almost impossible to make a joining satisfactorily without proper mechanism being provided for this purpose. In some of the slow running looms provision is made for this by the operation of each set of rolls independently (see Fig. 1), by means of the ratchet gear and pawl A and worm motion B. This plan has the one disadvantage of taking up too much space between the individual pieces. Where the fabric woven is say four or five inches wide, and the space will admit, it is all that can be desired, and the individually weighted rollers C associated with the motion are admirably adapted to variable pressure.

For the very narrow elastic fabrics, which require considerable roller pressure to hold the web snug and firm while weaving, and where it is necessary to make very accurate joinings after a break has occurred, a better movement is one in which the web roll is placed on the main take-up shaft in the form of a sleeve. It is carried around by the shaft as it turns while the goods are being woven, but can be released and turned both backwards and forwards by a conveniently placed hand wheel, which operates a series of differential gears. This movement is entirely independent of the movement of the main take-up shaft drive.

Tension on Rubber Warp

To much importance cannot be attached to properly controlling the tension of the rubber warp. On its uniformity depends not only the quality, but also the cost of the web. The greater the weight of slack rubber woven into the web the more costly it becomes and the poorer the quality. A very accurate sense of touch is required in testing the tension of the rubber threads as they are being delivered into the goods.

The rubber warp requires the highest possible tension before breaking or chafing of the thread takes place. Each rubber thread should be under this high tension so that when the goods come through the press roll the desired contraction will take place uniformly, and a flat piece of web will be produced that will have plenty of life.

It must always be remembered that the individual threads of rubber which constitute a rubber warp will act as a series of small springs, working in unison with each other. Each one should have equal power to contract the fabric at its own particular part. If any one of these strands or springs is chafed and weakened, it lessens the contracting power, and the result is that the weakened or less contracted part is of relatively greater length than the parts where the rubber threads have retained their full power.

Moreover, the appearance of the goods will be spoiled by the chafed particles of rubber pricking through the face, particularly on the white and lighter colored goods. Before such webs can be marketed they must be

subjected to a buffing operation to remove these dirty particles, which is accomplished by passing them over a highly speeded, cloth covered roller, which will remove the loose particles by friction and high velocity. But this operation adds to the cost.

A high and uniform tension of the rubber warp is so important that most manufacturers keep men specially employed in the testing of the threads, instead of leaving this matter to the weavers. These testers acquire such a keen sense of touch that they can obtain very economical and satisfactory results. Talc or soapstone is freely used as a lubricant to reduce the risk of chafing and breaking of the rubber threads. The warps are

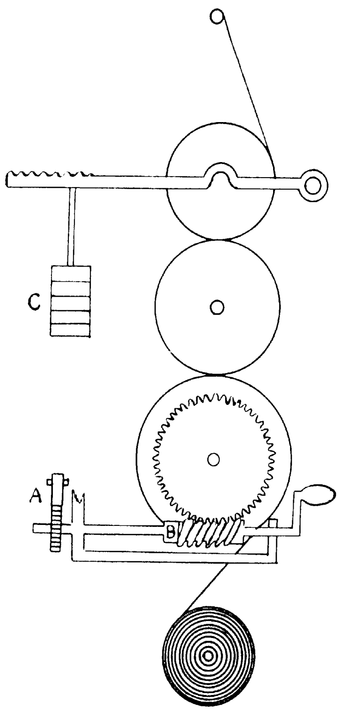


Fig. 1.—Individual Take-Up Motion for Wide Space Looms

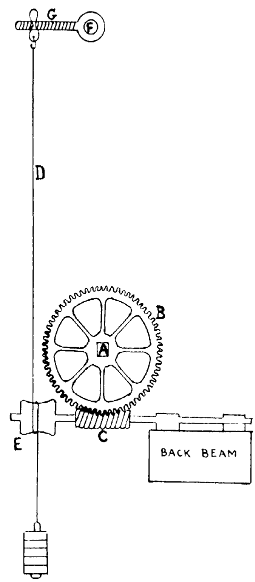


Fig. 2.—Individual Rubber Warp Let-Off Motion

arranged so as to allow the threads to pass through a bed of plush, loaded with talc, which adheres to the rubber threads and makes them work very smoothly. This is especially important in damp weather, which is the worst condition for the weaving of elastic goods. At times factories have stopped operations when the weather was especially humid.

Let-Off Motion

When we remember that the front reed will pass by the rubber threads possibly six or seven hundred times from their entrance into the shed to their reaching the leaving line, it is not to be wondered at that chafing is liable to take place. With all this liability of spoiling goods it becomes

readily apparent that any device employed to regulate such an important feature as the tension of the rubber warps must be very sensitive and dependable.

On looms making wide goods, and where space will allow, regulation is accomplished by a worm and gear movement as shown in Fig. 2. The iron rubber beam is threaded on to a square shaft A, at one end of which a gear wheel B is fastened In this gear is meshed the worm C, which is operated by a heavy linen cord D passed twice around a pulley E. The cord derives its movement from a rocking shaft F, on which there is fastened a screw extension G, by which adjustment can be made so as to deliver very accurately any amount from the rubber beam.

With this kind of movement, and in order to feed the thread uniformly into the web, it becomes necessary to use mechanically made warps where the same uniformity has been maintained in putting the warps on the beams. The warps so made must come from the thread manufacturer in individual warps, which are done up in chain form, each warp containing the requisite number of threads.

Making Rubber Warps

The machine used for making the warps, shown at Fig. 3, is mounted on an iron frame A, which carries the power driven warp beam B Behind this is an open top expansion reed C, the dents of which are regulated to open, coarse or fine by an internal spring which is regulated by a hand wheel. This reed also has a screw sidewise adjustment for centering. Behind the reed C are fixed two pairs of nip rolls, D and E, and an open roller F, which is followed by a belt driven beater roll G, used to beat the threads out straight as they leave the chain.

The rubber warp is first laid on a cloth on the floor, under the beater roll. The end is then passed over the beater roll G, over the open roll F, through the two pairs of nip rolls D and E, over the expansion reed C, and then looped to a leader on the rubber beam, where the knot is put in a countersink on the beam barrel, so as not to interfere with the lay of the warp. The section of the warp between the two pairs of nip rolls is brought down in loop form, shown at H, and the nip rolls are then closed while the warp is in this position. The two sets of nip rolls are speeded alike and the rubber is always kept slack between the gripping points, so that all threads passing through the last set of nip rolls, D, are perfectly gauged in length and tension when passing through the reed C and on to the beam B. The threads of rubber are under considerable tension, inasmuch as the beam B is driven faster than the nip rolls D and E.

Friction Let-Off

Where there is limited loom space, and where a small number of threads are employed, as in the narrower garter fabrics, it is not as practical to have the warps made mechanically, and for this reason they are not likely to be put on the beams with as much uniformity of tension. In such cases it becomes necessary to have some automatic device that will correct any irregularities and maintain a uniform delivery throughout. The device for doing this is shown at Fig. 4.

The warp carrier A is fastened to the back rail, which carries the warp, over which is passed the friction cloth G which is hung from a rod D. The friction cloth is fastened at the bottom to the graduated warp lever E, which is bolted to the bottom rail H, as shown. The rubber threads constituting the warp pass in a direct line to the harness C, and then to the breast beam B. The lever E, and the weights F, allow for proper adjustment of the friction cloth so as to keep the lever level as the warp beam empties.

In making the rubber warps for narrow fabrics such as garters and

suspenders, where the last described method of warp delivery takes place, it is customary to work from an entire sheet of rubber, splitting it up into the required sections or strips of the various sizes called for in the

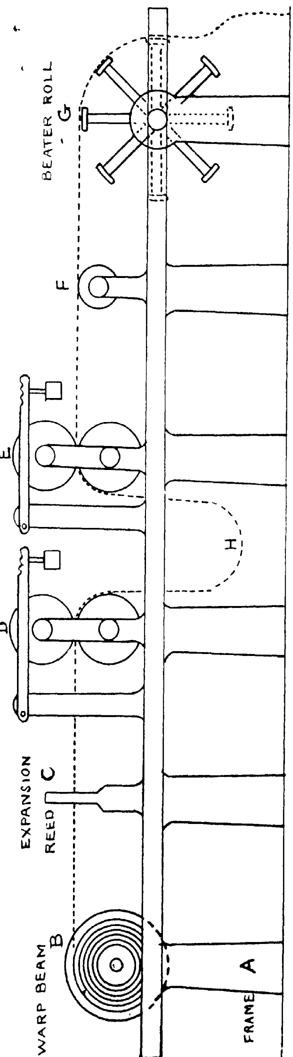


Fig. 3.—Rubber Warping Machine

warps. This splitting and warping process must be done in a long room where the warp can be stretched out to its full length, if possible, after it is unchained. These warps are usually about 60 yards long. The "head"

of the sheet, or the part where the cutting knife has not gone through, is spread out flat on a series of hooks at the beaming machine and the tail end is fixed securely on a strong hook at the other end of the room.

The requisite number of threads for the several warps which are to be beamed are counted off and each different section is fastened to a beam. The end knot is laid snugly in the counter-sink made in the beam barrel for this purpose. A wide reed is used, covering the number of beams operated in the machine, which is usually about four, and the threads are reeded over spaces opposite the different beams. This reed can be moved sidewise across the face of the beams and each warp properly centered so as to keep the warp level. The operator then starts the beaming machine, which may be operated either by hand or power, and the warps are wound

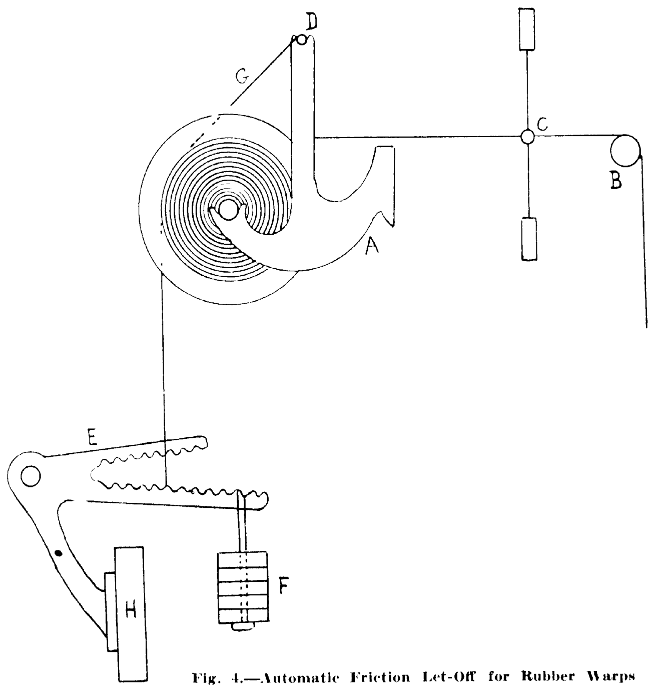


Fig. 4.—Automatic Friction Let-Off for Rubber Warps

up. At the same time a helper walks towards the beamer carrying the tail end of the warps and keeping the tension as nearly uniform as possible. When the warps are all wound on the several beams, a lease is taken in each of them in the ordinary manner, and each separate section is securely fastened.

Should floor space be limited, a horizontal reel is used, which is about six feet long and about five feet in diameter. On this the sheet of rubber is wound after being split in proper sections at the head end and divided by a coarse reed, so as to be able to distribute the different sections all across the reel. Each section can then be taken off the reel as required for the beams. The tension of the threads is governed by a weighted leather strap passed over the face of the reel.

Chapter III.

Head Motion Looms and Dobbies for Making Fancy Effects—Tying Up Harness—Construction of Loom Webs, Lisle Webs, French Web or Railroad Weave and Cable Webs—Making Good Selvages and Preventing Long-Sided Effect

So far we have mentioned only plain looms, or those limited to the capacity of eight or twelve pick cams. Before we consider any of the varied constructions relating to elastic webs it will be well to speak of fancy looms. There are different types, adapted to a wide range of fancy effects, but the fancy loom most generally used is what is known as the chain head, an example of which is shown at Fig. 1. Such looms are usually of 18 and 24 harness capacity, and are operated by a figure chain of the length required to produce the desired figure. Chains are made up of a series of bars, one bar operating with each pick of the loom and having on it space for a roller or sinker for each harness to be operated.

Wherever a roller is placed on the bar, the corresponding harness will be raised, and wherever a sinker is used, the corresponding harness will be dropped. A series of rollers following each other will hold the harness up, and likewise a series of sinkers following each other will keep the harness down, thus maintaining at all times an open shed.

The Shedding Operation

The shedding operation is very simple. In the fancy head there are two cylinders, each of which has gear teeth running the entire length. These cylinders operate continuously in opposite directions The teeth of the cylinders do not go around the entire circumference as will be noticed on the upper cylinder shown in Fig. 1, but there is a blank space provided so as to allow for the engaging of the gear wheels brought into position at the right time as the cylinders revolve.

Between the two cylinders are vibrator gears, one for each harness, and to these gears are attached arms which are connected with the different harnesses. These vibrator gears can be thrown into position by the chain rollers or sinkers, so as to come in contact with the teeth of either the upper or lower cylinder, and are so timed that they take their position at the moment when the blank part of the cylinder presents itself. A vibrator gear engaging the upper cylinder is turned so as to lift the harness connected with it, while a vibrator gear engaging the lower cylinder drops that particular harness. The harnesses stay in their relative positions until the chain calls for another change.

Both cylinders and engaging gears are made of hard chilled steel, so that wear and tear by hammering at the time of engagement are reduced to a minimum. To further soften the engagement, the speed of the cylinder is controlled by elliptical driving gears, which reduce the speed of travel just at the moment when the engagement takes place.

The timing of the various movements of the head is so well controlled that there is little risk of any part failing to maintain proper relationship with the other parts. But in the event of any accident or breakage occurring which interferes with the free motion of the head, such strain is taken care of by a soft pointed set screw on the head driving shaft, which shears off and so prevents further serious damage.

The capacity of the head is such that by careful arrangement of figures and repeats it is quite possible to make several simple designs to run side by side in the same harnesses and this is often done. Of this we may write more later.

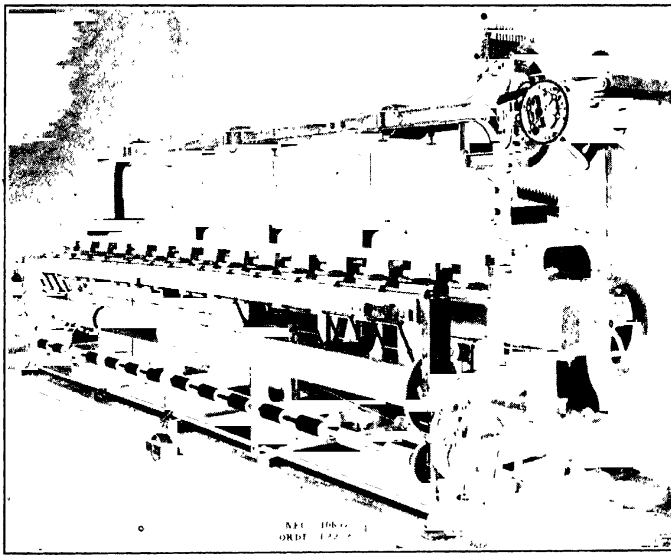


Fig. 1.—Fancy Loom for Weaving Narrow Fabrics

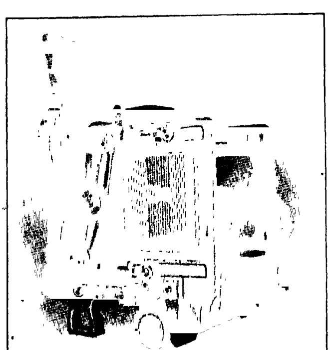


Fig. 2.—Double Index Dobby

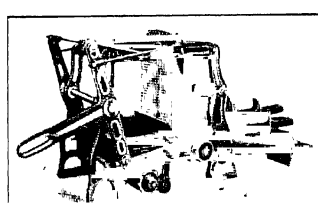


Fig. 3.—Overshot Dobby

The Overhead Dobby

A popular machine for light fancy warp figures is the overhead dobby shown at Fig. 2, which may be used as auxiliary either to the plain cam loom or the fancy head loom. It is placed on a well braced, rigid frame and built as high as convenient so as to reduce the angle of the harness strings. It is driven directly from a two to one shaft, which may be either underneath the loom or at the end, and is connected with a threaded adjustable rod, which is attached to a slotted lever and can be adjusted to govern the depth of the dobby shed.

It is customary to put two of these dobby machines over each loom, but having only one main drive the two machines are coupled together and work in unison. Such an arrangement has the double advantage of a less acute angle at the harness tie-up, and also affords facilities for a distinctly different pattern on either half of the loom. It minimizes the risk of the harness threads cutting into the compart boards, and prolongs relatively the life of the dobby harness. Furthermore it allows for a straight tie-up on either machine so that there is no limitation to the length or character of the design, as is often the case where two patterns are run together on the same machine, or where point tie-ups are used, as would very likely be necessary if only one machine was installed to cover different designs on both halves of the loom. As we have previously stated it is not advisable to limit capacity for the saving of a few dollars in the initial cost.

Overshot Dobby

Another type of loom employed in the making of fancy goods is what is known as the overshot loom. It is used for the introduction of a silk weft figure effect, and is probably the most pronounced form of elaboration introduced. It differs from the old rise and fall method in the economy of operation. The overshot continues to weave the body of the goods right along while the auxiliary shuttle is putting the silk figure in at the same time. Not only is it economical in the respect of greater yardage, but the method employed in binding the figure limits the use of silk to the actual figure displayed, and does not carry the silk, which is the most expensive material in the fabric, to the extreme selvage at every pick, as is the case where the rise and fall method is employed.

In the overshot system a specially designed dobby, shown at Fig. 3, is used for operating the lightly weighted threads of the binder warps. Two pairs of knives are employed, one of each pair operating far enough to raise the threads used in the binder warp to the level of the top main shed, while the other one of each pair carries the threads which are used for figure purposes to a higher level, so that the overshot shuttle may pass under them. This occurs every alternate pick of the loom, the body shuttle making two picks while the upper or overshot shuttle makes only one.

In levelling the harness, setting or timing of the loom, and making the shed for overshot work, the plans followed are identically the same as in ordinary single shuttle work, as the upper shuttle and upper shed are distinctly auxiliary and subordinate to the main shed. The binder warp, being necessarily but lightly weighted in its relationship to the upper and lower cloths it is binding together, allows for the figure threads to be strained out of their normal position, so that the upper shuttle may pass under them. In order to conform to this strained position of the binder figure threads, the upper shuttle must be acutely pitched downward at the nose so as to get a good clearance, and thus avoid any binding in its passages through the shed. This peculiar downward pitch of the shuttle is very important and cannot be over emphasized. It is shown in Fig. 4.

Cable Web

The most popular web now made up into men's garters is what is known as the cable web, shown at Fig. 9. With the pronounced prominence of the two-dent rib, which gives it a character peculiarly different from the plain web, it is well adapted to this class of goods. Simple in appearance, it nevertheless requires special care to manufacture, particularly when we remember that it is not unusual to be required to make a finished stretch of not less than 100 per cent. The harness draft and weave are shown at Fig. 9A. The construction is as follows: Binder, 34 ends 80/2; Gut, 24 ends 20/2; Rubber, 18 ends 28s; Reed, 20 dent, Picks, 80 per inch; Stretch, 100 per cent

The filling, floating across the wide spaces under which lie the rubber threads in pairs, is very easily thrown out of place, the result of which may be an unsightly seersucker appearance, as shown in Fig 10, which the process of finishing aggravates rather than corrects.

Trouble may manifest itself by the filling over the ribs opening up and allowing the gut threads to prick through. To prevent this objectionable feature it is necessary to use a good quality of moderately soft yarn for the gut, not necessarily of high grade stock, but a yarn which is uniformly spun and not at all hard or wiry. As these goods are being woven and on full stretch, the gut threads, of course, are perfectly straight and accurate in line, but when contraction takes place, to probably one-half the former length, these heavy threads, which form probably about 25 per cent. of the weight of the entire web, should bend or fold uniformly and dispose of themselves in such a manner as not to appear in any way on the face of the web, snugly housed away in the several pockets or cavities. If the yarn composing these gut threads is spotty or irregularly spun, this uniformity of fold inside the pockets will be broken up and the appearance of the face of the goods is likely to be marred by unsightly specks of cotton pricking through, which can be both seen and felt.

Chapter IV.

Elaboration of Honeycomb Effects by Parti-Dyed and Printed Fillings—Bandage and Surgical Webs Made with Plain and Covered Rubber—Frill Web Woven on Cam Looms—Double Cloths—Importance of Securing Balance Between Back and Face of Goods

AMONG the group of single cloth webs confined to the capacity of plain looms, is what is commonly known as the honeycomb, shown at Fig. 1 and Fig. 1A. This is generally made with silk, wood silk, or schappe filling. The smooth filling floating over two cords gives the web a smooth feel, there being no rib effect noticeable whatever, making it well adapted for a fine trade. The warp lines are almost entirely hidden by the filling, so that it is not practicable to introduce any sharp stripe fancy effects, which can be done both in the plain web and the cable. The honeycomb is thus confined to plain solid colors or such elaboration as can be obtained from the filling.

Fancy effects are often secured by dyeing skein yarn in two or more colors. Such yarns when woven in the goods produce alternating effects at regular distances in different colors, such distances being governed by the length of the dips and the width of the goods. The effects which can be produced are quite varied. The simplest way of accomplishing this is to use the regular 54-inch skein, having white or some light shade as a base, and then dyeing a given portion of the skein another color. This process is carried out by hanging the skeins on sticks placed in a rack at the required distance above the color liquor, and then lowering them into the vat and dyeing the immersed part in the usual manner.

Where cotton is used for the filling and more elaborate effects are desired, long reeled skeins are used, sometimes 108 or 216 inches, which have been reeled on specially designed collapsible reels. Such skeins are not practicable to handle in the dye house in the manner already described. Sections of such skeins are wrapped in heavy waterproof paper and tied tightly, so that the dye liquor cannot penetrate that portion, and then the whole is put in the liquor, when the exposed part only will be dyed.

Then again sometimes wood clamps are used, like that shown at Fig. 2, having a recess into which part of the skein is laid after being carefully folded. The two halves are clamped together tightly in such a manner that the dye cannot penetrate the clamped part of the skein while the part left outside the clamp is dyed when the whole is immersed in the dye liquor.

Printed Filling

Another form of elaboration used in such goods is printing the skein yarn used for the filling. This is done by using a machine having a pair of fluted brass printing rolls, one of which is made to open on a hinge like a gate so that a skein of yarn can be put around it. This roller is then closed to its original position, so that with the two rollers parallel and close together, and the skein of yarn hugged tightly between them, the turning of the rollers imprints color on the skein. The skein is then taken out and dryed before spooling. Different sets of rolls are used so as to get fine and coarse effects and various colors are used in printing.

Where plaids or printed fillings are used for the elaboration of webs of the honeycomb type, it is not unusual to introduce a couple of plain cords in the center of the web, or possibly on either side, so as to break up the flatness of the weave. This opens up the opportunity of using lines of a different color in the warp which properly arranged will produce a plaid-like effect.

Double Cloth Webs

Our remarks so far have been confined exclusively to single cloth webs of a simple character, where, apart from the rubber and gut there is only one warp used, and where both back and face of the web are alike. We will now turn our attention to what are known as double cloth webs, where two distinct cloths are woven, one for the face and one for the back, each working independently of the other, but tied together by another warp known as the binder, or else the two cloths interlock each other in such a manner as to bind them together without the assistance of another warp.

By this method of weaving much thicker and heavier webs may be produced with a limitation of elasticity which cannot be obtained by the single cloth method. The weaves and materials employed in the face and back of the goods may be identical, or weaves of a different character and stock of different qualities, sizes and colors may be used. Fancy effects may be used to embellish the face, while the back may be perfectly plain and free from any coloring whatever.

There are certain features associated with the construction of double cloth webs which make them entirely different to deal with. The different weaves and the different stock employed necessitate splitting up the warps into sections to accommodate such conditions. A separate warp is required for both back and face and also one for the binder, which delivers a much greater length of warp than either, necessitated by the character of the weave used in binding the upper and lower cloths together. A separate warp is also required for the gut, which goes in the web perfectly straight and is shorter in length than any of the other sections. Such goods also require a special warp for the selvage, so that in the simplest form of such webs a bank of five warps is necessary. On fancy goods the introduction of fancy warps may add to this number.

Balance Between Back and Face

The element of a right balance between the back and face has to be considered, and if care be not taken in the proper adjustment of the stock the result may be that one side of the goods will assert control over the other in such a manner as to prevent it lying flat and even. When such a web is cut it will curl up so as to be almost uncontrollable. Such a condition may arise from a variety of causes. If the weaves of the face and back cloths are identical then it will be necessary to have the face and back warps of the same size yarn or its equivalent. For instance, should the face be a four thread plain and 40/2 is used, and the back only two threads, then the yarn used for the back warp must be 20/2 so as to equal the four threads of 40/2 in the face. Should, however, the face be a more open weave than the back, then an equal weight of yarn in both cloths will not be right, and it will be necessary to use yarn of a heavier weight for the face to compensate for the freedom of the more open weave and effect a proper balance with the more tightly woven back. There can be no fixed rule to apply to this, and only experience will indicate the proper relationship between the two. In Figs. 6 and 6A are shown the simplest form of double cloth, known as a plain web.

By carefully following the weave it will be seen that while the face weaves 3 up and 1 down, and the back 1 up and 3 down, the filling will appear both on the face and back of the goods as 1 up and 1 down. If the binder was not there it would be a tubular web, having the same appearance all around. The binder, however, intersects the upper and lower cloths at each pick and binds the two together in one complete whole, while the rubber lies between the two, each strand being separated by the interlocking binder threads.

It becomes necessary in order properly to connect the upper and lower cloths at their extreme edges to use a selvage warp, which as will be seen in Fig. 6A is drawn in on all four face and back harnesses, and the threads of which are arranged so as to complete the weave all around. To do this it will be seen that there is an odd thread at one side, otherwise the weave at this point would show two threads operating together next to each other, and would break up the continuity of the weave.

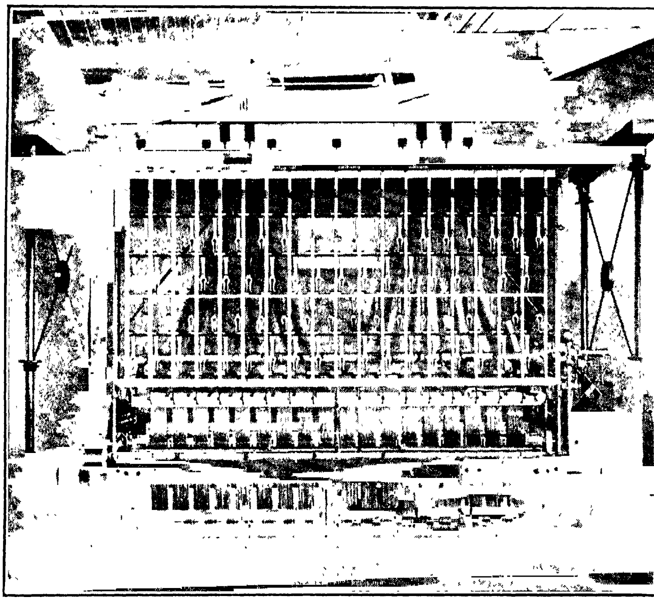


Fig. 7.—Method of Banking a Set of Warps for Double Cloth Webs

The selvage plays an important part in the structure and weaving of the web. It forms the pocket for covering in which lies the outside rubber threads, and it must be so arranged that these threads can function properly so as to make a piece of goods that will lie flat. In the first place the yarn must be of such a size that with the proper number of threads employed the selvage will contract uniformly with the body of the goods, so that the web will not "frill" on account of a too heavy selvage, or "belly" because it is too light.

Care for Selvage

The threads must be properly divided in the front reed so as to make a good clearance for the filling, which otherwise would "rib" up and make an unsightly selvage. Then again, a careful adjustment of the weight carried on the selvage warp must be made so as to accommodate it to the requisite tension of the filling as it is delivered from the shuttle, otherwise the edge rubber threads will be liable to chafe and cut off when strained out of proper alignment with the front reed. It will be observed in the draft that two rubber threads are used in each selvage, which is necessary in order to control the additional yarn used in the construction of the selvage.

Chapter V.

Three Leaf Twill or Satin Face Woven in Conjunction with Plain Back—Position of Back Rolls in Relation to Harness Shed—Use of Four Leaf Twill—Filling Fancy Effects and Stitch Figures—Interchanging Figure and Face

TURNING our attention from plain webs to combination weaves, we will take up what is popularly known as the three-leaf twill, or satin face, woven in conjunction with a plain back. This is a type of web not only used for suspenders, but employed extensively for corset garter attachments also. A web of this character when properly constructed has a smooth velvet-like face. The threads are uniformly distributed across the width without showing any of the "rowy" effect from the binder warps, which are completely hidden by the heavy pile produced by the float of the face threads. When the contraction of the web takes place, these floating face threads mass together in a velvet-like pile, not only producing a smooth handling web but materially increasing the thickness. Such webs are generally constructed with a six-thread face and a four-thread back, and have what is termed a round edge, similar to the selvage used on a plain web. This arrangement shows up the twill face by contrast and gives the fabric a much finer appearance

Harness and Chain Draft

Fig. 1 shows the harness and chain draft of such a web, together with the construction of a properly balanced web for standard goods of $1\frac{1}{8}$ inches wide. It will be noticed that the face, consisting of 150 threads, is split up into two warps of 75 threads each. This arrangement is necessary in order properly to weigh them so as to get a good clearance in the shed. The warp has to be divided likewise in the harnesses and put on six harness frames, although the weave could be produced on three. It would not be practicable to crowd 50 threads on one harness frame in the narrow space available, as the harness eyes would shoulder and crowd too much when changing.

In drawing-in this web, one face warp should be arranged so that the threads are drawn on the first, third and fifth harnesses, and the other face warp should be on the second, fourth and sixth. Such an arrangement in the distribution of the warps makes it much easier on the mechanism, and minimizes the risk of breakages. It is also important to make proper divisions of the warps at the back rolls, inasmuch as some of the warps have to be weighted heavily while others are only lightly weighted, and also on account of the different take-up of the varied weaves.

The back rolls should be set in a graded position so as to prevent undue friction of one warp against another. The binder warp should be worked under the front roll on account of the extremely light weight this must carry. Fig. 2 shows the proper position of the back rolls in relation to the harness shed.

In a web of this character where the warp stock is somewhat crowded in the front reed, there is always a tendency for a fibrous yarn to prevent a perfect clearance in the shed, with a liability of producing occasional floats through the shuttle skipping these threads. Such floats will pearl up when the web contracts and make an imperfect face. This trouble may be prevented by setting the back rolls a trifle higher than the breast beam rod, so that the stock in the harness which is down will be slightly tighter than that which is in the upper harness.

The chain draft is so arranged that the face harness will operate to produce a twill which will be reverse to the twist of the yarn employed, and thus reduce the prominence of the twill weave all possible. The filling yarn should be soft, of about 15 turns per inch, and of good uniform quality, in order to produce a nice selvage and not cut the rubber. The reed dent inside the selvage rubber should be carefully twisted at an angle to conform to the nipped in position to the rubber thread, so that the outside edge of the dent will not cut the rubber when the reed beats against the goods at the weaving line.

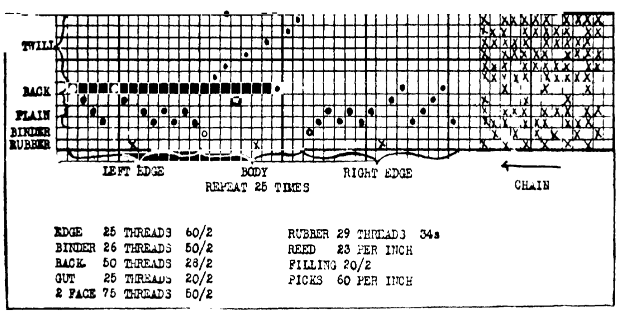


Fig. 1.—Three Leaf Twill, or Satin Face, Woven in Conjunction With a Plain Back

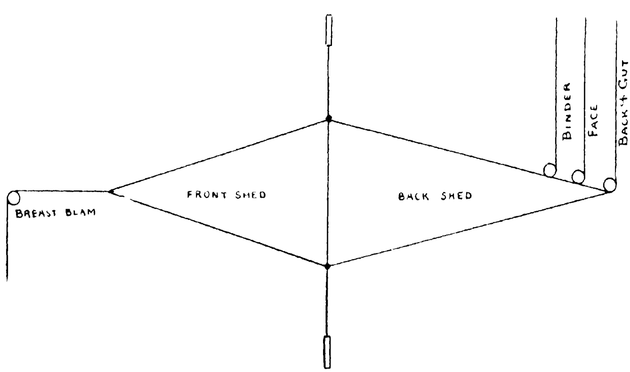


Fig. 2.—Showing Position of Back Rolls in Relation to Shed

USE OF COARSER YARN

A fine looking twill may be produced with a somewhat coarser face yarn by using a five threaded face over a six thread repeat. This is shown in the harness draft at Fig. 3.

In non-elastic fabrics there are available a variety of twill and satin weaves for the production of soft lustrous surfaces, but this is not so in elastic webs, as the contraction of the goods after weaving would produce a ragged, spongy surface. A float of three picks on the face is about the limit it is practicable to go on an elastic web, with few exceptions, and even this only in connection with fine picking.

Use of Four Leaf Twill

A four leaf twill, however, can be used to great advantage when a heavy body is desired, as for example what is known as "farmer's web." These are usually made about two inches wide, and to further add to their weight they have what is termed a cushion back, the weave of which is 7 down and 1 up. The use of these soft weaves on both face and back, while giving the web great thickness on account of the deep velvet-like pile produced, deprives it of much of its firmness. This condition is met by the introduction of an auxiliary back warp, underneath the main back warp, weaving 3 down and 1 up, which knits the upper and lower cloth more firmly together, thus increasing the firmness of handles of the goods.

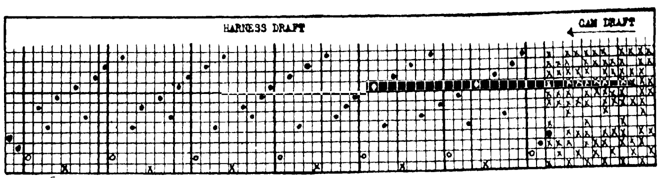


Fig. 3.—Five Thread Face Over 6 Dent Repeat

Another web among the plain loom products calling for passing mention is that specially made for the police and fireman's brace. While this has a 7 down and 1 up cushion back similar to the farmer's web, it differs in having a smooth plain face in place of a twill This arrangement of combining a plain face with a cushion back necessitates selection of the sizes of yarn used for the various wraps so as to maintain a proper balance of the different weaves employed in the face and back. Otherwise the goods would curl up and it would be impracticable to cut them up for manufacture. Consideration must also be given to the effect of padding the size upon such goods in the finishing process, of which we will say more later.

Filling Fancy Effects

All the webs so far described have been such as could be produced on cam looms of various capacities. We will now turn our attention to what are generally understood as fancy effects It might be well to treat these under two distinct headings. Those made with the shuttle, or what are called filling patterns, and those made from the warp, or what are called stitch patterns.

The figures or fancy effects produced by floating the filling over sections of the warp show up the filling with increased luster in contrast to the warp. They are confined to no particular character of design, and may range from the simplest effect produced on the fancy harness loom or dobby to the more elaborate jacquard design. The ground or body may be either plain or twill, or any other acceptable weave suitable as a base for figuring, while the filling may be of a contrasting color, either of silk or cotton as desired. The figure or design may be made from the same shuttle used for the ground or it may be made by an auxiliary shuttle, either used as an overshot or rise and fall, according to the character of web desired.

Where the figure is made from the ground shuttle it is produced as a sunken effect. It is made by burying sections of the face warp at intervals so that in place of the face warp the filling is seen at these points. No additional figure warps are required for this class of goods, and elaborate designs are obtainable, although there is not the scope for cross coloring that there is in the warp figure method.

Stitch Fancy Patterns

When the design is made from the warp, the figure threads are made to float on the face of the goods so that upon contraction of the web after weaving, these floats pearl up in prominence above the level of the face, and make what is termed a stitch figure.

It is not our purpose here to particularize in design, which is practically unlimited, but only to refer to those features which govern the construction and illustrate as necessary. In order to maintain a proper

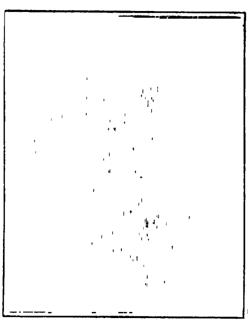


Fig. 4.—Point Draw Stitch Figure

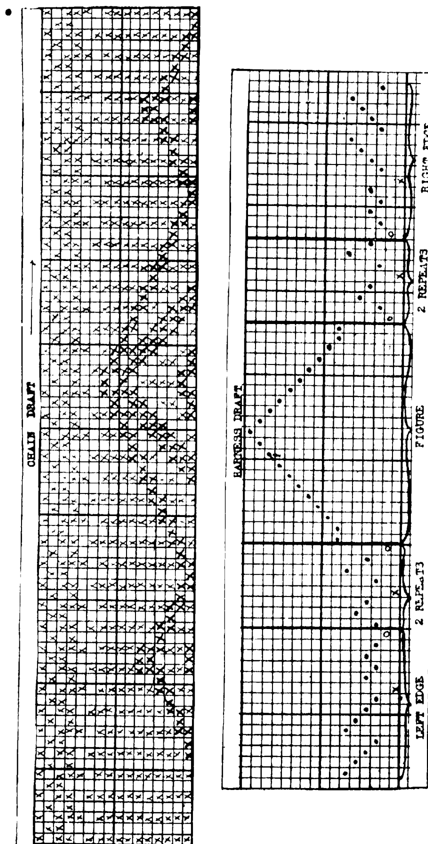


Fig. 4A.—Harness and Chain Draft for Fig. 4

balance where figures are introduced on single cloth weaves, it is necessary to distribute the figure warp uniformly over both the face and back of the goods so as to maintain a proper balance between the two. In the double cloth webs the figure warp, when not appearing on the face of the goods, is allowed to run straight between the upper and lower cloths, going in the same cavity or pocket as the rubber threads, and it works at these times as a gut. This, of course, in a measure interferes with the contraction

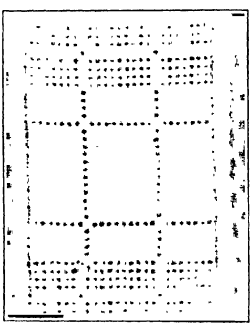


Fig. 5.—Interchanging Figure and Face

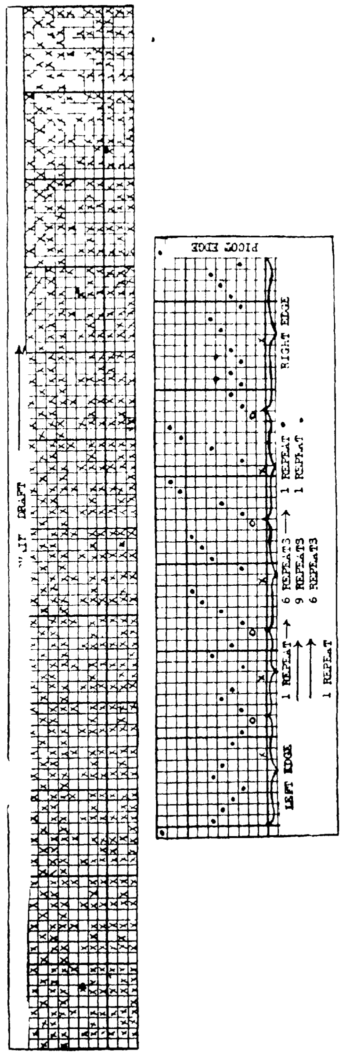


Fig. 5A.—Harness and Chain Draft for Fig. 5

of the goods and has to be taken into consideration in the construction. Here again we must note the effect of the contraction in piling up the floating-figure threads, and the necessity of limiting the floats in making the design so as to avoid any ragged appearance.

Fig. 4 shows a design of this character, with the harness and chain draft at Fig. 4A. In this particular web there are six harnesses used for the main body and ten for the figure, which is a point draw. While the figure is evenly distributed on the web, wherever it is not seen it is running between the upper and lower cloths, as already described, and acting as a gut.

In order to get a proper balance of the web it is necessary to put gut threads into the two outer cords where no figure appears, which must be equivalent in size to the figure threads employed in each of the 21 center cords. If this is not done the web will contract unduly at the edges and make it "belly." The method here used of burying the figure between the upper and lower cloths when not needed in carrying out the design, affords opportunity for introducing additional warp threads of different colors, so as to be able to bring up either one color or another as desired in a design.

As most of the fancy head looms have not more than 18 harnesses, it will be seen that the scope of design in this class of loom is somewhat limited, therefore much ingenuity is required to get elaborate designs from such limited capacity. But careful study opens up a variety of methods by which a big range of designs is possible.

Interchanging Figure and Face

Fig. 5 shows another type of design known as the "interchanging" fancy in which the figure warp does not pile up above the surface as it does in the stitch figure, but remains flat with the face of the web. The harness and chain drafts are shown at Fig. 5A. In this character of design a given number of face threads are duplicated by a like number of figure threads, the same size of yarn being used for both. These face and figure threads are drawn in duplicate harnesses and operated just reverse to each other, so that when the figure is up at any particular part, the interchanging face threads are down, and vice versa The figure weaves only three picks up on the chain draft, which is one face pick seen on the face cloth, and this produces a perfectly flat web.

Another form of elaboration is shown in this web, known as the "picot" edge. It is generally made of a well cabled thread of silk and is woven in the selvage, being bound in for several picks and then allowed to float outside, so that upon the contraction of the web it will pearl out in small loops, adding much to the elaboration of the web.

CHAPTER VI.

Combination of Weaves in a Fine Web—Sunken Effects Made on Head Motion and Jacquard Looms—Employment of More Than One Bank of Shuttles—The Overshot Method—Use of Different Colors and Grades of Stock—Binding Long Floats

A VERY effective combination of weaves in a fine web is seen at Fig. 1. The middle of this web has for the face a 7 up and 1 down weave, but the yarn and picking are fine. The yarn piles up just enough next to the plain edge weave to set off the weaves in contrast to each other. It will be noted that on either side of the silk figure there are two cords with the binder thread left out between each, which further sharpens up the contrast. The fancy effect is produced by the use of a heavy cabled cord, the two outside threads being of reverse twist, so that when they pearl up on contraction of the web, one turns to the right and the other turns to the left, making an effective border.

SUNKEN EFFECTS

An altogether different type of figuring is seen in Figs. 2 and 3. Both of these webs illustrate what is known as the sunken effect. In both cases the face is a three-leaf twill, which character of weave is most effective in hiding the filling beneath it. Therefore, the figure may be worked out in sharp contrast. In Fig. 2, which is made on a fancy head loom, it will be noticed that the face threads on the fifth cord on either side are left out in order to assist in the carrying out of the plaid effect aimed at in the figure. It will also be seen that the face warp is striped in color. The character of the figure is such that the major part of the face warp is operated in one solid block, making it practicable to produce this on harnesses worked on a chain loom.

In the web illustrated at Fig 3, each thread is operated in the design independently. Such designs are only producible on a jacquard loom. But inasmuch as the threads used in forming the figure are confined to the face warp, it is not necessary to operate the back or binder threads from the jacquard. It is more convenient to have these worked from the cams or fancy head in combination with the jacquard, for the reason that a truer and clearer shed can be obtained.

Furthermore, by having the back harness and the jacquard operated from two distinct movements it becomes possible to time them differently so as to obtain better results in the clearance of the stock in the shed. A 208 hook machine affords ample capacity for the making of these goods, allowing for 26 rows of 8 hooks each, which will cover the requirements of nearly all classes of web, giving an entire row to each cord. Such arrangements will allow for six hooks for the face, one for the binder and one for the gut on each row. Thus it will be practicable to use different colored threads for the gut, which may be brought up in the design in relief effects to the main figure as required.

CALCULATION FOR FIGURE DISTRIBUTION

In this type of figuring, calculation must be made to distribute the figure uniformly so as to get a well balanced flat effect of the web. As already stated, wherever the filling is shown, all the face stock at these points is buried between the upper and the lower cloths, and is acting as filler or gut in these places, preventing contraction. Should heavy blocks be thus designed, the web would pucker up in an unseemly manner. The

filling used should be soft and uniformly spun, so that it will mass well together and in a great measure prevent the buried face stock from pricking through.

In designing webs of this character, calculations have to be made from the web after it is woven and finished, otherwise the design may be out of the desired proportion. A web may have 60 picks per inch on the breast plate while weaving, but when contraction has taken place after going through the press, it may have shrunk as much as 50 per cent. The steaming and finishing process may further contract it another 10 per cent. which might make the picks about 100 per inch. Of these only one-half appear on the face and the other half on the back. Therefore 50 picks per inch will be the proportion in which the design should be made, and paper scaled according must be used.

Cross Shot Weaving

We have so far confined our remarks to webs made on single shuttle looms. Turning our attention to the use of more than one bank of shuttles we would first make note of what is known as the cross shot. This is a form of weaving which largely increases the output and has in it the further element of economy, inasmuch as by this method the rubber warp can be worked at a much higher tension than by the single shuttle method.

In the construction of single shuttle webs, the rubber harness rises and falls at each passage of the shuttle across the shed This movement creates a friction on the rubber thread at the harness eye and an added friction at the front reed by its passing up and down in the dent. Friction is still further increased by the backward and forward movement of the lay, which makes two such passages to one made by the cross shot

In the cross shot method, the rubber remains stationary, with no upward and downward motion, which enables the rubber thread to be stretched out to its extreme limit while weaving, with little danger of chafing or breaking. Over and under this stationary rubber are two distinct sheds, one making the upper and the other the lower cloth These two fabrics are stitched together by the binder warp, which travels up and down through both of these sheds

In order to keep all the warp threads uniformly tight while shedding, it is necessary to run these under separate back rolls, fixed at different heights, properly centering the upper and lower sheds with the harness and breast beams.

Position of Rolls

Fig. 4 will explain the position of the various rolls in relation to the breast beam. It will also show the peculiar formation of the shuttles used for this type of weaving, both pointing to one common center, made necessary by the character of the two sheds. The bow of the upper shuttle must be tipped downwards, and the lower bank must be tipped upwards, so as to reduce the friction of the shuttles all possible when they are passing through the sheds.

The round edge or covering for the outside rubber threads is drawn in the harness on the upper shed, and while being woven this cloth is pulled around the rubbers by the tension of the filling which is carried in the lower shuttle. This tension is greater than that carried in the upper shuttle, and so asserts itself by pulling the edge cloth around the outside rubber until it meets the back cloth weave. The upper and lower fillings are connected by what are known as tie threads. These threads are drawn in the harness at each side of the body warp, next to the edge, and are part of the binder warp. They are operated from the binder harness, but are only allowed to travel through the lower shed as far as the center of the

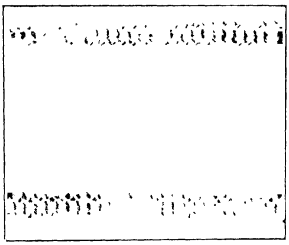
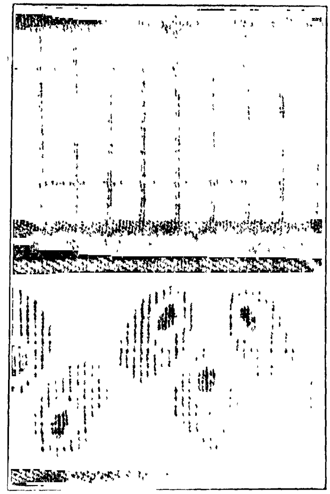


Fig. 1.—Effective Combination of Weaves in a Fine Web



Figs. 2 and 3.—Sunken Effects

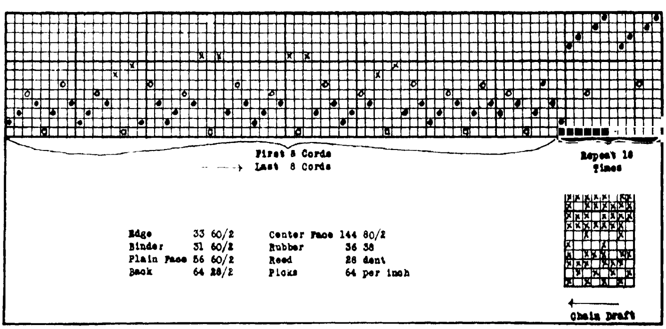


Fig. 1A.—Harness and Chain Draft for Fig. 1

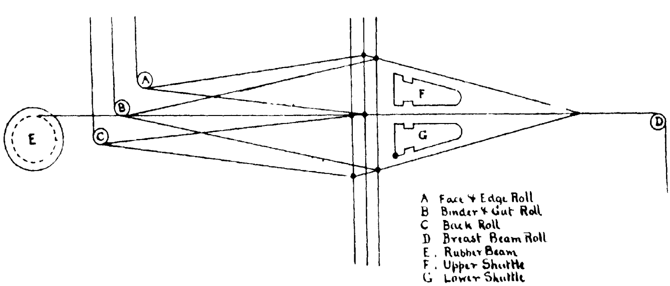


Fig. 4.—Position of Rolls in Relation to Breast Beam for Cross Shot Weaving

web, instead of going all through both sheds, as do the balance of the binder warp. This movement is accomplished by the use of long looped harness eyes, which only carry these particular threads through the one shed.

The binder movement, extending through the two sheds, is formed by a longer sweep from extra throw cams, or by the use of extended cam jacks, or by a combination of both. The balance of these goods may be regulated both by the warp and the filling, and any tendency towards curling may be corrected by changing the weight of stock used on either.

Use of Different Stocks and Colors

The use of upper and lower fillings also allows for the use of different grades of stock in either shuttle. Colors may be used to match the face warps while white may be carried in the lower shuttle to match the back. Silk or other expensive stock may be used for the face without changing the character of the stock used for the back of the goods, which is not practicable in single shuttle work.

All this of course makes it possible to reduce the cost, making this the most economical web produced. In the making of shoe goring, a considerable quantity of which is still used for inserts for house slippers, this is a very popular form of weaving, allowing for the production of a face having a velvet-like pile of the color to match the shoe leather, while the back may be perfectly plain and white.

It is a method employed in combination with the jacquard, where fancy figures may be obtained on the face, using the cam movement for the back, binder and edge, the weave of which is the same for all of these warps, being simply a one up and one down. In such a combination the labor on the jacquard movement is much reduced, inasmuch as the travel of the lingo is much shorter than is required when made in connection with single shuttle.

The Overshot Method

The overshot method, which we have previously referred to, is another form of double shuttle web which has in it elements of economy differing from the cross shot but equally important. This kind of weaving is designed as a substitute for silk jacquard webs, which it has to a great extent supplemented. Before its introduction it was customary to use a slow running "rise and fall" lay movement, when making a silk figure with the shuttle, putting in one pick of silk filling to each two body picks, so that the output of web was only about one-half of what is possible in overshot weaving. In the old method the silk used to pass from edge to edge of the goods at each pick of the figure shuttle, and where the figure did not appear it was buried between the upper and the lower cloths.

In the overshot method the silk figure is bound down at the edge or border of the figure and none of the silk is entirely buried out of sight. In the overshot the body shuttle runs all the time, while the figure or silk shuttle only runs with every alternate pick. The main body of the goods is woven in every respect the same as in a single shuttle web, and it may embrace all the weaves, such as plains, twills or fancies, which are common to single shuttle weaving. Arrangements are made, however, for the production of an auxiliary shed, by a movement which pulls certain threads above the main shed, and while these are open to pass the extra shuttle under them, and thus bind in the figure filling. The lower part of the lay has straight shuttles, while the upper bank of shuttles is tipped down to conform to the formation of the auxiliary shed they are designed to pass through.

The binder threads from which the overshot figure is generally operated, are weighted very lightly so that the individual threads will easily stand

the strain they will be subject to while making the auxiliary shed. The Crompton & Knowles overshot dobby is generally used for this purpose. This special machine is provided with two horizontal draw knives, operating any or all of the 30 hooks, and is so arranged that the connected warp threads may be lifted at either or both picks to the height of the main shed, or to the additional height of the auxiliary shed.

Fig. 5.—Simple Overshot Design

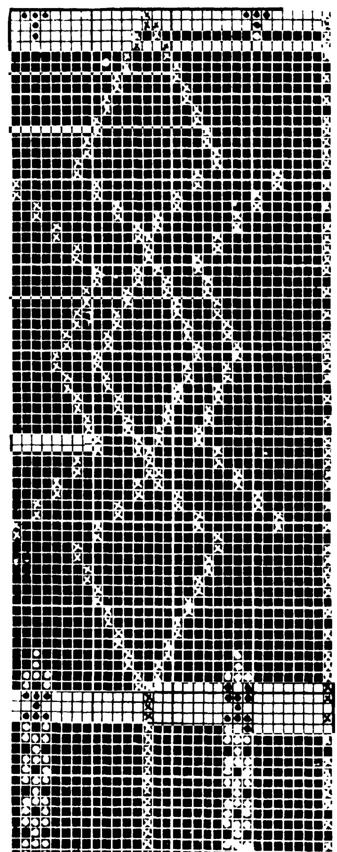


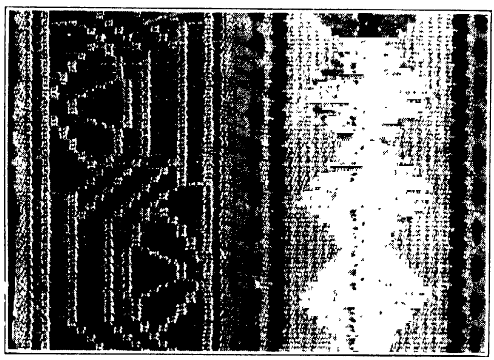
Fig. 5A.—Draft for Fig. 5

In Fig. 5A is seen the draft of a simple overshot figure covering 23 hooks, which are operated from one knife drawing in unison with the binder harness, while the other knife is operating on the alternate shed, or the heavy pick, and working in unison with the rubber harness. It will be noticed that in the overshot design both sides of the figure do not operate alike, but follow one pick behind the other. This is so arranged

that the binder may come up at the right pick to properly bind down the silk in the goods, and so avoid any irregularity or ragged appearance at the border of the figure.

Making Overshot Designs

In making overshot designs, care must be taken not to have the silk float too long, or it will give the goods a rough coarse appearance. Should the design call for a long span over a number of cords, it will be necessary to bind at intervals as shown in Fig 5A, and at each succeeding pick to break the order of the binding as may seem advisable. The stitch or warp figure coming up at each side of the main figure, must be pegged on the dobby chain to operate on the reverse knife to the overshot figure, so as to work on the pick when the binder harness is down.



Figs. 6 and 7.—Other Forms of Overshot Design

Fig. 6 is an example of another form of overshot design, known as the "matelasse." In this the silk filling extends from side to side of the web, as in the old form of jacquard, being bound down at different points, the bindings forming the figure.

Fig. 7 shows still another form of overshot made by the operation of the gut as figure instead of the binder, and which is worked on the heavy pick instead of on the binder pick. This is done so that the intersecting cords of face, which hide the silk at different points, can be raised in order that the figure silk be hidden underneath it. To accomplish this, each of these face threads is passed through slip leashes, which are operated from the dobby. These slip leashes allow for the working of the face thread in the main harness. At the same time it is possible to raise them to the height of the upper shed so that the silk shuttle may pass under them.

CHAPTER VII.

Making Frills in the Middle of Goods—Woven Shirred Effects—Novel Decoration at Edge of Fancy Frills—Lappet Weaving on Elastic Fabrics Affords Opportunity for Elaboration at Small Cost—Production of Pearl Edge—Special Fancy Drafts

WOVEN elastic fabrics are open to many forms of elaboration that are not possible in non-elastic weaving. We have already made mention of the frills woven at the outer edges of the goods, formed by the fluting of non-elastic sections produced by the contraction of the center part. This same effect may also be used in the center of the goods. To accomplish this it becomes necessary to employ a distinct set of harnesses to operate each half of the web, together with additional harnesses on which the frill sections are drawn in.

The chain draft is arranged so that the shuttle is made to pass through one-half of the web and a half section of the frill, and then return. The shuttle then passes through the other half section of body and frill. The operation is repeated continuously. Fig. 1 shows a sample of web in which the frill is brought up for a distance and then buried inside the goods for a short section. Fig. 1A gives the harness and chain draft.

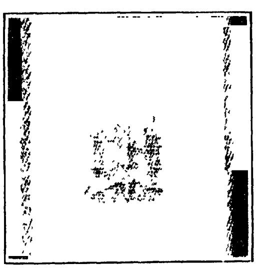


Fig. 1—Web With Center Frill

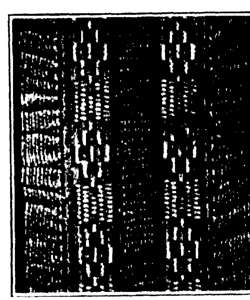


Fig. 2—Fancy Figure With Seersucker Center

The weave used for producing a frill may also be used in the center of the main body; it then produces a seersucker effect. At Fig. 2 there will be seen an example of this, in combination with a figure on either side of the seersucker, the figure part being bordered with a regular frill. The insertion of this seersucker section lessens the number of rubber strands used in the whole, and it therefore will be found advisable to use a somewhat heavier size of rubber in the remaining cords to compensate for this. The harness and chain draft for Fig. 2 are given at Fig. 2A.

WOVEN SHIRRED EFFECT

Another example of an effective form of fancy elastic weaving may be seen at Fig. 3, where the center or rubber part of the web is made to imitate a shirred effect. In the regular method of shirring a piece of plain elastic web is used, under tension, and is passed through a sewing

machine where a wider piece of ribbon or some other light non-elastic material is stitched to it by a series of needles running side by side. When the web contracts, upon being released from tension, the non-elastic part forms in a regular fluting on the face of the web. At the same time the

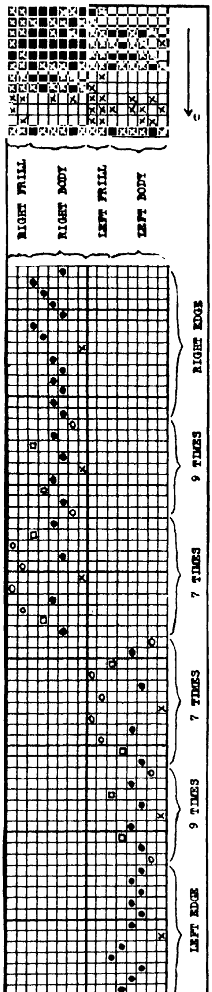


Fig. 1A.—Harness and Chain Draft for Fig. 1

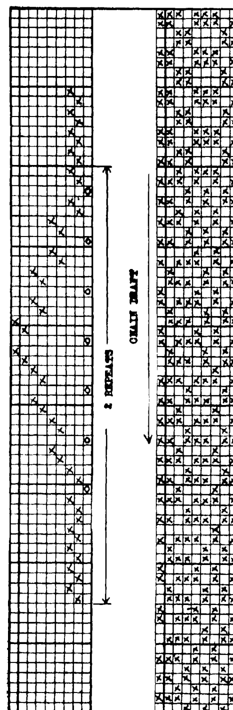


Fig. 2A.—Harness and Chain Draft for Fig. 2

remainder of the wider non-elastic section frills up on either side of the elastic part.

The method of producing this effect direct upon the loom is done by an interchange of weaves, first making a short section of single cloth

and then changing to a short section of double cloth weave. There being no binder warp employed to knit the upper and lower cloths together, the strands of rubber will lie between the two cloths so formed. Upon the contraction of these strands of rubber the outer cloths are thrown out, and appear as flutings on the web, while the side sections in which there is no rubber will compete the frill effect. This woven method has in it the advantage of making both sides of the web alike, whereas in the stitched shirring the back of the goods is not so presentable and unfits it for many uses. It also eliminates the added expense of labor in assembling the different parts.

Novel Decoration at Edges

A novel form of decoration is seen at the extreme edge of the fancy frill at Fig. 4. This may be produced by what is known as the draw-in method. This effect was formerly produced by the use of additional banks of shuttles in a rise and fall lay, but is now made by using two threads of cabled silk coming from spools, these threads being worked by the harness the same as a warp. They are very lightly delivered by a delicately adjusted return spring arrangement. The threads are operated on a special harness, being passed through the harness eyes outside of all the other warp stock, and then through a dent in the front reed as far away from the other stock as is desirable to form the size of the loop required.

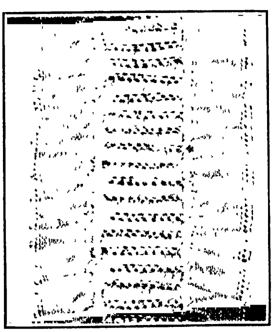


Fig. 3.—Woven Shirred Effect

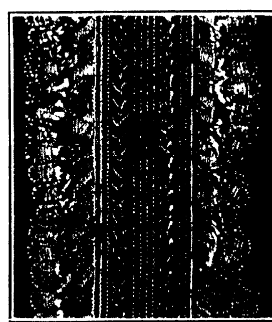


Fig. 4.—Novel Edge Decoration

The harness used for these threads stands still a given number of picks, and at regular intervals is brought down so that the draw-in thread comes in contact with the shuttle filling, which then passes around it. As the shuttle returns through the open shed, the filling or weft pulls the easily running draw-in thread with it, until it comes in contact with other warp threads, which the filling passes around, and so stops the further progress of the draw-in thread into the shed. The thread at the same time is carried around a wire which works in a dent next inside the one in which the draw-in thread passes. Quite a variety of fancy effects may be produced in this manner. Threads of different materials and colors may be used and drawn across the face of the web at different points, and selvages of a distinctly different color and character to the body of the goods may be made.

Lappet Weaving

Lappet weaving on elastic fabrics is a method which has not been extensively used, probably on account of the limitations of design obtainable by this style of weaving. Nevertheless, it affords opportunity for considerable elaboration at a very small cost. The loom attachment which permits the making of these patterns, which are somewhat similar to embroidery, is known as the lappet motion. Wherever it has been used it has been found to be serviceable. It can be attached either to a plain loom or a fancy loom. It is a system of levers operated by a chain composed of different sized balls, arranged according to the pattern desired.

On the loom lay are one or two slides running the full length of the lay, which are moved laterally by the different sized chain balls. They can also be raised and lowered as required by the design. Both these slides have generally three needles for each suspender web, which are spaced at equal distances apart, one or all of which may be threaded and used. When slides are lowered into the web, the shuttle filling or weft passes over the yarn which is carried in the needle eyes and binds it into the cloth. Then by moving the slides backward and forward for succeeding picks, and each time binding the thread into the cloth, the various lappet patterns are produced.

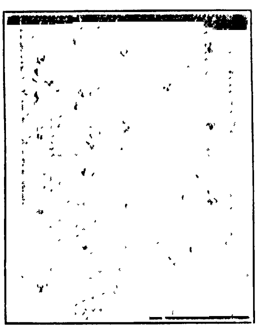


Fig. 5.—Lappet Weaving

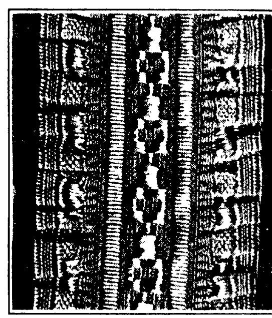


Fig. 6.—Broken Effect on Silk Frill

The figures are mostly irregular trailing patterns, as shown at Fig. 5, and well adapted to narrow goods. Dots of different sizes and in different positions may also be made, but it is not practical to get the finely finished lines which can be obtained from other methods where there is positive control of any particular warp threads or group of threads, as for instance in jacquards and overshots.

The sliding bar of the lappet motion may vary slightly in its movements so that the needles will not always pierce through at exactly the same points at each repeat of the pattern, although the general design will be maintained. The threads which feed the needles should be of good clear ply material, free from slubs and irregularities, so that they will pass freely through the needle eyes, and they should have enough turns to enable them to withstand the friction resulting from the backward and forward sliding movements of the lay passages. The yarn must be delivered from independent spools, which work with perfect freedom, and measures should be taken to control the stock by the use of delicate springs.

The material used for the lappet figure is perhaps best run from grooved spools which are so weighted that they feed easily through the needles at every forward movement of the lay.

PEARL EDGE

An effective and inexpensive method of elaborating a silk frill is found in what is known as the pearl edge. This adds much to the richness of the goods, besides giving the appearance of greater width at slight increase of cost. The pearl edge is produced by a series of fine steel edge wires, which are carried in separate dents of the front reed outside of the frill itself. Each wire is operated by a special harness which brings it into the weaving lines as desired, so that the filling may pass around it and make pearl loops at these particular places. It will be found necessary to use hard steel dents in the front reed to work the wires in, otherwise the dents will soon be cut from the constant wear of the wires.

A silk frill may also be much enriched by special fancy drafts. These allow for the operation of groups of threads so that the filling passes over and under them and show up the luster of the silk filling in blocks contrasting with the more plainly woven parts. An example of this is shown at Fig. 6.

Chapter VIII.

Designs Produced by Use of Jacquard in Connection with Cams or Head Motion—Weaving Buttonholes in Webs—Manufacture of Surgical Belts and Bandages—Combination Woven and Printed Designs—Method of Printing

IN previous articles we have confined our remarks to the production of elastic fabrics on plain and fancy looms. These machines are more or less limited in capacity, and the stock must be operated in groups of threads. Considerable care is necessary in the selection of patterns best adapted to these looms. In jacquard weaving each separate thread is controllable, and the scope of pattern and design is limited only by the space available on the face of the fabric.

Of course certain general rules, which have been laid down for the production of designs on fancy looms, are applicable to the making of jacquard designs. For example, where sunken effects are aimed at it is necessary to uniformly distribute the buried stock, just as it is in the fancy loom method; otherwise uneven or "cockled" web will result on account of these being too much buried stock at some particular point, which prevents uniform contraction.

Designs in Sunken Effects

Fig. 1 is an illustration of a pattern where the sunken effect is well distributed. This pattern also shows the operation of two sets of figure threads brought up alternately. Both warps are buried to allow the back filling to appear in relief. This indicates the wide scope of design possible on a single shuttle, which is almost unlimited.

Fig. 2 illustrates a double shuttle design which has a sunken warp effect in connection with a silk figure. It also serves to illustrate the effect of skein dyed silk for decorative purposes. Fig. 3 shows still another type of double shuttle design, in which a parti-colored face warp lends an entirely different effect to a design. Fig. 4 is an example of three shuttle work where one shuttle is used for the ground, and two shuttles for the silk figure.

It would be easy materially to enlarge on the various types of design possible in jacquard weaving of elastic webs but this is not necessary. If a straight tie-up is used the scope of design is almost unlimited. The custom generally adopted is to operate the back, rubber and gut from chain or cam harness, as the same movement of all these threads is maintained continuously, and to operate the face and binder from the jacquard. Fig. 5 is an illustration of a fully rigged jacquard suspender loom, having two machines mounted on it, and with the back and rubber harness operated by the fancy head.

Jacquard Tie-Up

Too much emphasis cannot be laid on the necessity for exercising the greatest care in the jacquard tie-up and the leveling of the strings. As already stated in a previous article, any failure in the initial arrangements will result in constant trouble and faulty work. Mispicks and floats may not be serious in many types of non-elastic fabrics, but in elastic webs a float will so pearl up on construction that the goods will be ruined. Once again, and of the greatest importance, measures should surely be taken to have some form of screw adjustment for the raising and lowering of the jacquard machines to compensate for expansion and contraction of the strings, caused by changing atmospheric conditions.

Weaving Buttonholes

In the assembling and making up of narrow elastic fabrics, particularly suspenders, it is often necessary to use buttonholes in the finished products.

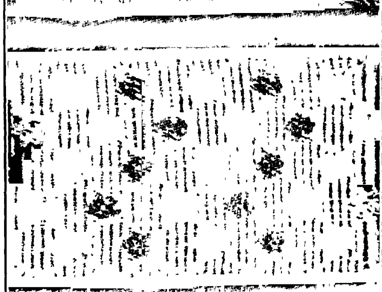


Fig. 1

Fig. 2

Fig. 3

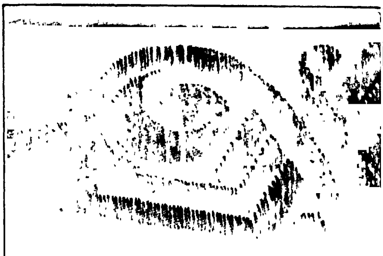


Fig. 4

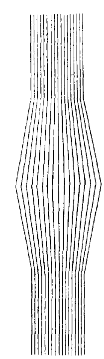


Fig. 6.—Formation of Abdominal Belt

Sometimes the buttonholes are cut and worked on the ordinary buttonhole sewing machines, but on account of the difficulty arising in the controlling of the strands of rubber when it is cut for working, a very unsightly buttonhole often results. It has therefore been found advisable to weave the buttonholes, particularly for what is known as the "Guyot" suspender, where elastic pieces having buttonholes are used for the back ends, and non-elastic straps, also having buttonholes, are used for the front straps.

The loom will automatically weave the buttonholes at any desired place, and at the same rate of speed at which the plain part is woven. This is accomplished by the use of two banks of shuttles, both of which are running in the same direction at every pick of the loom, but only one of

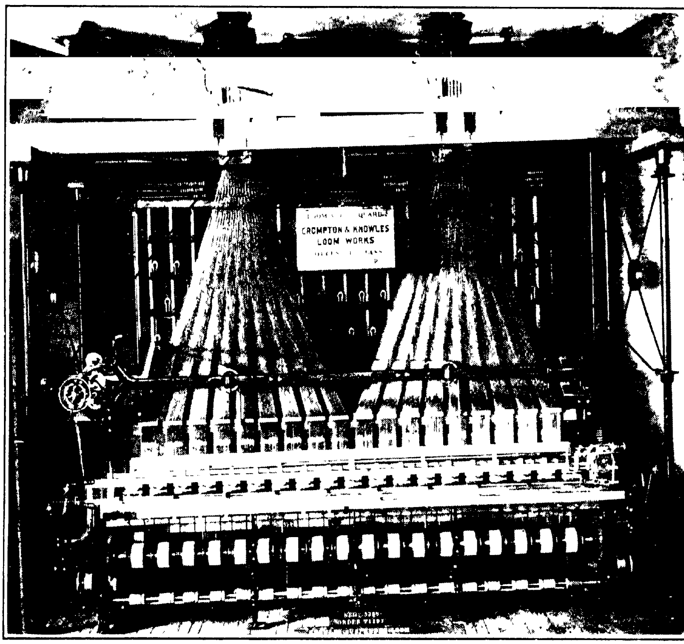


Fig. 5.—Jacquard Suspender Loom With Two Machines and Fancy Head

which, (the upper) is engaged with the cloth while the plain part of the goods is being woven, the other bank running "dead" underneath the goods during the operation. When the buttonhole is about to be made, two distinct sheds are formed and then the two banks of shuttles are engaged, the upper bank on one half of the strap and the lower bank on the other half, until the completion of the buttonhole. Then one shed is again formed in place of the two, and the upper bank resumes the operation of weaving the plain part of the strap.

This process of changing from the single to the double shed is accomplished by the use of a specially designed cam jack made in two sections, to which are attached two harness frames, in each of which one side of the strap is drawn. While weaving the plain part of the strap both sections of the cam jack operate in unison, running side by side from the

same cam, but when the buttonhole is "called on" a device for spreading apart each pair of cam jacks is operated, and the two sheds are then formed. At the same time a lever movement changes the position of the lay, so that the two banks of shuttles take new positions and properly engage the two sheds.

Facilities are provided for governing the length of the straps and the position and length of the buttonholes When the lower shuttle is not engaged in the buttonhole shed, the filling may run loosely beneath the goods, and require trimming off between the buttonholes This trimming may be avoided by operating the center binder thread, putting the same in a skeleton harness and giving it an extended shedding so that this particular thread may be dropped below the main shed and allow the lower shuttle to engage it. By this process the thread is bound in the goods at every pick of the loom and does not need trimming

The elastic back end, having a buttonhole in it, is also made on a special loom, which has a "rise and fall" movement of the lay It has a chain fancy head with what is known as a Gem multiplier on it for regulating the length of the plain part, so that one repeat of the plain weave can be multiplied indefinitely and the buttonhole chain called on as desired

In making up sections of elastic webs for various purposes, particularly when required to be attached to garments, it is often found that the joinings are bulky and unsightly on account of their thickness A web is made on the special loom just described of such character that it does away with this objection. A section of plain web may be woven of any desired length, and then another section made in which the upper and lower cloth are woven separately for a given distance After being taken from the loom this double section is cut in the middle, so that the non-elastic part may be used for attaching to the garment When thus made the rubber and binder lie "dead" between the two cloths, and are trimmed off after the non-elastic part is cut in two

Making Abdominal Belts

There is a growing demand for webs of various characters for surgical and orthopedic purposes One of these which calls for special attention is a web used in the manufacture of abdominal belts The width varies from about four inches, where it is used to support the back, to about six inches at the part which is used for the support of the abdomen.

Such a web is constructed in the regular manner employed on plain webs, except that it is woven in a deep front reed made to taper from top to bottom, from fine to coarse. This reed is arranged in a reed pocket attached to the lay bed, and is designed to slide up and down behind it. Underneath the lay is an adjustable screw mechanism, which is so operated that it can be made to remain stationary for a given length of time, and then gradually work up and down in a given period. This allows a web to be produced with a formation similar to that shown at Fig. 6.

The rubber cords lie close together while weaving the first narrow part, and gradually spread while operating at the wide part, returning to their original position for the other narrow end. If properly constructed the goods will lie perfectly flat at the narrow ends, and the opening up of the cords by the spreading of the reed dents at the wide center will give more freedom to the individual strands of rubber in this section, which will cause the goods to "belly" at this point. This rounding formation especially adapts them for the purposes for which they are intended. Various modifications of the taper web may be made in this manner, but the same general plan is applicable to all.

Printing Designs on Elastic Web

The printing of designs on elastic web is a form of embellishment which opens up large possibilities for variety of effect, and adds much to the selling quality of many webs at slight additional cost. Moreover it gives an opportunity for changing the character of many woven patterns which may not have proved good sellers, but when printed will often become the most popular patterns offered. A woven striped effect with a few crossbars printed on, transforming it into a plaid, changes its character entirely. Or a few dots distributed over a pattern hitherto undesirable may make big changes in its selling qualities.

But apart from this the field of original design is practically unlimited. The work is most satisfactorily accomplished by using oil inks of various colors, making proper arrangements for the drying so that the colors are absolutely fast. Colors should not be used which are more or less fugitive and liable to spread in the process of finishing.

The goods, when printed, are run loosely in cans and allowed to stand a reasonable time for proper absorbtion of the ink. They are then run slowly through a heated chamber to set the colors, a number of strips being put through the drying chamber at one time. The pattern rolls are best made with the design raised on the face of the pattern, and the ink uniformly distributed on the raised part. Care should be used to have the set of the rolls so adjusted that the part where the figure does not appear will not come in contact with the ink roll.

This method has proved better than using engraved rolls, besides being less expensive. After the design is drawn it is photo-engraved on a plate of a given length so that it may be shaped and fitted around the printing roll, great care being taken to have the repeat properly connected, particularly where the pattern is a continuous one without any break in the design.

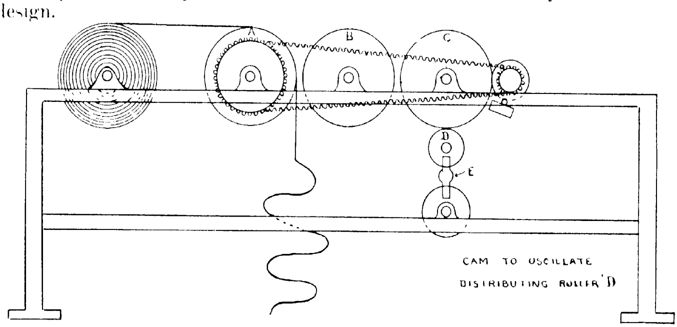


Fig. 7.—Diagram of Machine for Printing Elastic Fabrics

Fig. 7 is a sketch of a printing machine. The design roll A is five inches in diameter and constructed of a number of thicknesses of maple wood, glued and screwed firmly together, with the grain well crossed to prevent shrinkage and warping. The design plate is carefully fitted around and pinned securely to this roll. The rubber covered rolls B and C carry the ink and are positively driven. The small roll D, while revolving by frictional contact with roll C, is also vibrated sidewise by a cam-driven lever E, so as to distribute the ink uniformly. The rolls are run on steel centers and can be so adjusted as to center any given pattern on the goods.

All the roll carriers are fitted in a taper groove which is planed to the full length of the frame bed, so that the pressure of the different rolls can be accurately adjusted. The machines are easily operated and print 12,000 to 15,000 yards of web a day.

Chapter IX.

Making Warps for Elastic Fabrics—Quills for Use in Shuttles—Effect of Finishing Processes Must Be Calculated from Beginning of Web Construction—Details of Processes and Machines for Different Styles of Goods—Care to Avoid Acid in Goods—Rubber's Reaction on Copper

THE making of cotton warps for elastic fabrics, particularly for double cloth webs, involves considerable thought and care in view of the number of sections necessary for a properly constructed fabric, and the different weaves employed. Owing to the contraction of the rubber, it is essential at all times that the proper balance be maintained between the face and the back of the goods.

This necessitates a uniform weight of stock where the weaves on the face and the back are identical, no matter how the size of the yarns used may vary, and a variable weight of stock where the weaves are different. All this is determined by experimental work when establishing the grade. These conditions necessitate separate warps for the face and back. Then again the different weaves employed involve a variable length in the take-up and this alone would make it impracticable to combine the various weaves.

It is invariably the plan to use fine stock for the face and a coarser material for the back. Of course it would not be practical to put these together on the same beam. The crowded condition of material used necessitates the further splitting of the face and back sections. The binder, which takes up so much faster than any of the other yarns, also requires a special warp.

Selvage Under Special Control

The general appearance of the finished product being so dependent upon the character of the selvage, it is advisable to have these threads under special control, so that they may be treated in the best possible manner to produce a satisfactory shed, and allow the filling to get a good clearance. So as to secure a smooth well-rounded edge it is therefore necessary to have this on a special beam.

It will be seen, therefore, that in an ordinary piece of double cloth elastic web there will be required at least five warps: back, face, binder, edge and gut. Figures and fancy effects will often necessitate auxiliary warps. With very fine webs, having six threads to a cord, it is often found necessary further to split up the face to obtain proper working conditions. Figs. 1 and 1A show a six-cord web, together with warp calculations for the goods.

The employment of so many warps to each strip of web, which are automatically delivered by the friction let-off levers described in a previous article, prohibits the use of warps where the threads are equally distributed across the beam, as is the practice in wide fabrics, the method usually being to tape them on the beams.

Warping Machine

The required spools for the number of threads in the warp are put in a creel, each thread passing under an electrically connected wire, which is held out of contact by the running thread while the warp is making. If

the thread should break, the wire would drop and make an electrical connection which would automatically stop the machine. Fig. 2 shows a view of a warping machine such as is used for this work. They are generally constructed so as to allow for two or four beams, all of which may be run together or started, stopped or run individually, as required.

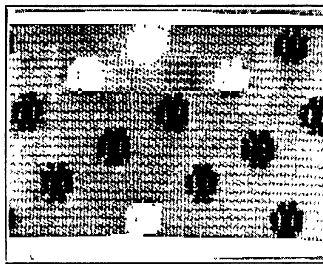


Fig. 1.—Six-Cord Web

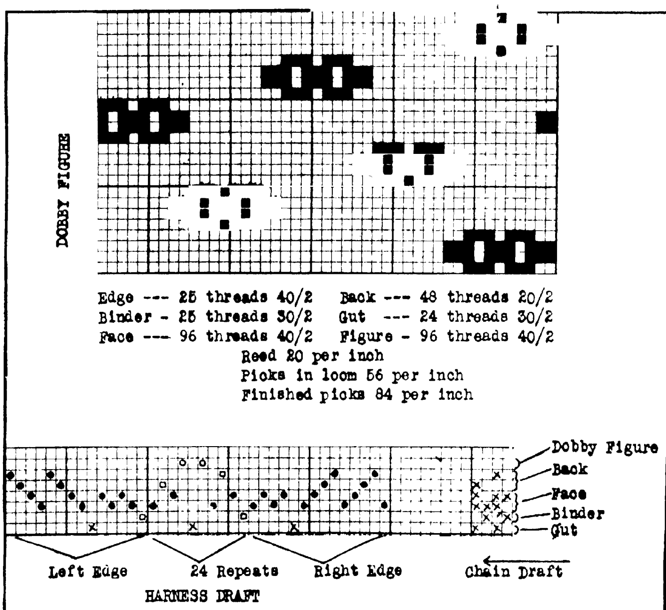


Fig. 1A.—Harness and Chain Draft for Fig. 1

Each beam is friction driven so that a uniform speed is obtained in the delivery of the yarn from the spools. Beams are also so arranged that they will stop automatically on reaching a given size. Each warp thread is passed through a pair of reeds, fitted with dead stops in the center of alternating dent spaces, so that leases may be put in the warps at fixed intervals to assist in keeping them straight in the looms.

In taping the warps on the beams, it is customary in some mills to run the threads over a small steel flanged pulley about one and one-half inches wide, which will keep each thread in its proper position and make the tape absolutely straight and flat as it leads to the beam. A perfect fabric is largely dependent upon how well the warps have been made, but it must not be forgotten that a good warp may be spoiled by a poor beam

Beam flanges should not lie flat against the warp creel standards, but should be kept clear by the formation of the head near the barrel, which should have enough prominence at this point to keep the flanges clear, and thus reduce the friction to a minimum The edges of the flanges should be perfectly smooth so as to allow for uniform delivery by the contact lever. Much of the beam abuse which occurs in many mills might be avoided by provision being made for beam racks at convenient points

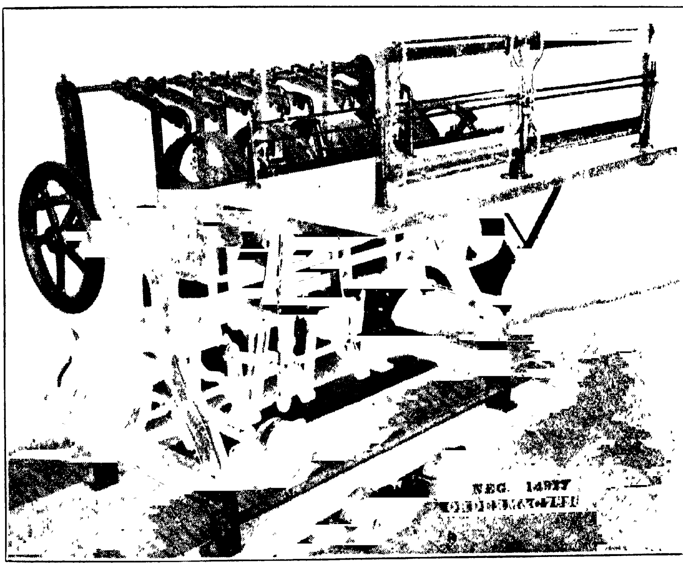


Fig 2—Warping Machine

Quills for Shuttles

The making of proper quills for use in the shuttle is of no small importance, for on this the evenness and uniformity of the selvage very much depends. When flanged wood quills are used, the guides should be carefully adjusted so that the filling is uniformly spread over the entire length of the quill, allowing for perfect freedom at each end without dragging. Quills should not be overloaded. In drum pressure quilling, the automatic stop should be so arranged that the quill will be filled even with the outer edge of the flanges and no more.

Should there be any tendency to hardness in the material used for filling, it may be found advisable to run the thread over a plush pad on which has been applied a light application of cocoanut oil, but great care should be exercised not to overdo this as there is nothing so hurtful to rubber goods as oil.

The quills should only be of sufficient length to allow for uniform delivery from the shuttle without dragging at the ends. To assist in this elongated shuttle eyes are preferable to round ones, so as to shorten the angle at which the filling leaves the quill when running from the extreme end. Thumb bits should be so adjusted that the delivery is uniform from start to finish. The quill flanges should not lie flat against the sides of the quill opening, but should be pointed at the ends so as to reduce the friction. Quill wires should be of hard tempered steel and be perfectly straight at all times. When it becomes necessary to run narrow goods in wide spaces, recoil springs should be provided to gather up the loose filling.

Care Required in Finishing

The finishing of elastic fabrics is a process which demands great care, and has to be taken into calculation from the beginning of the web construction. Calculations must always be made as to what effect heat, moisture and sizing will have upon the covered up elastic threads, confined as they are in a multiple of small cavities and under high tension. As soon as the softening influence of heat and steam operate upon the covering of cotton yarn which confines these threads, the rubber strands begin to assert themselves and contraction at once takes place. To what extent this can go must be predetermined in fixing values, and a certain degree of uniformity of contraction arranged for

Webs which are perfectly flat and straight when taken from the looms are liable to be transformed into unshapely products and completely ruined by unsuitable finishing. For instance, take a web with a twill center and a plain border which is apparently flat and satisfactory at the loom. The effect of heat and steam upon such a web will be to contract the soft woven center more than the harder woven plain border, which will cause the web to be long-sided and curl. Such a condition must be anticipated in the construction of the web and provision made to offset its occurrence. Sometimes it must be met by a change in the size of some of the yarns used, or number of threads employed at given points, or perhaps added gut threads must be introduced to stop contraction in certain places. It must always be remembered that we are dealing with a very much alive element when we are finishing rubber goods, and that unexpected results may at any time arise.

Finishing Machines

Finishing machines vary both in design and capacity, but the general principle is the same in all. A series of drying cans are arranged for the application of the sizing mixture. Some machines are laid out horizontally and some are upright. In the longitudinal layout the machines are more easily accessible in their different parts and under better control, while the upright machines are more compact and occupy less floor space. Fig. 3 shows a horizontal machine of the latest type. It has a drying capacity of eleven cylinders, 24 inches wide, 36 inches in diameter, allowing for a web contact of about 100 feet. These cylinders are arranged in two decks so as to economize in floor space.

The goods first pass through a pair of independently driven circular brushes, fixed at the feed end of the machine, to clean them from lint and dirt before being steamed and dried. They next pass between two pairs of nip rolls between which are fixed the steaming and sizing attachments.

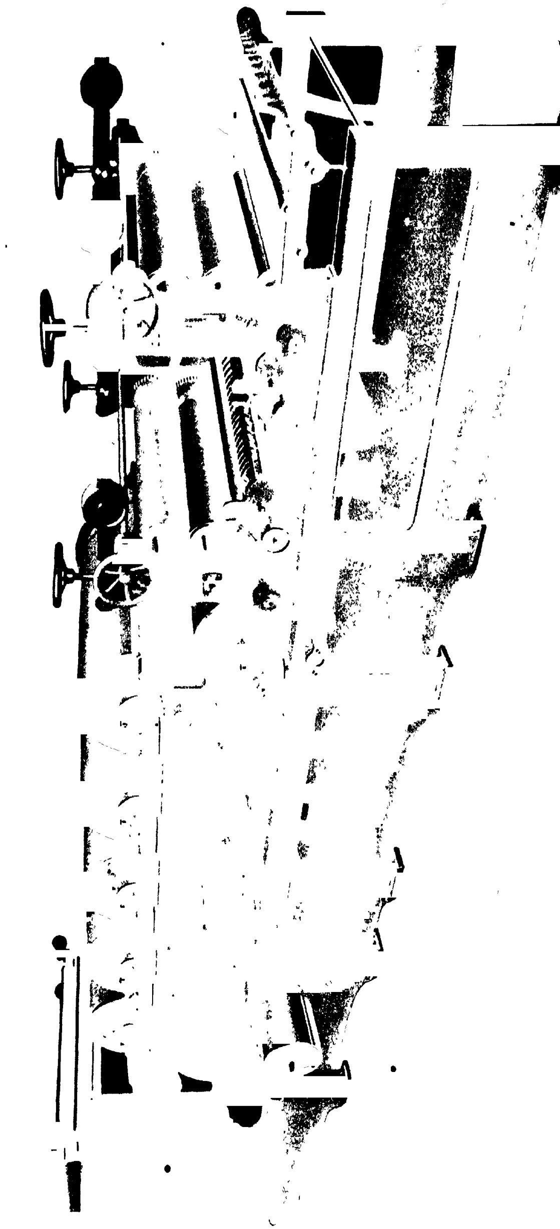


Fig. 3.—Narrow Fabric Finishing Machine

The goods pass through dry high pressure steam which is confined in a steam chest. They pass into and out of this chest through slots underneath the cover. A trough carries the condensed steam away from the goods and prevents dripping, otherwise they would be spotted.

The steam pressure must be carefully controlled so as to get uniform shrinkage of the goods. The steaming process softens the cotton, and the rubber threads, which are under considerable tension, gradually creep up and contract the goods. The steaming also makes the web more absorbent and thus prepares it for the size bath, through which it is passed under submerged brass rollers. The size is kept at a uniform heat by steam heated copper coils The web then passes through the second pair of nip rolls, which are worked under pressure so as to squeeze out the size before the web reaches the drying cans.

Allowance for Contraction

The first of the dry cans is usually covered with cloth, so as to absorb any size which may remain on the surface of the goods and allow it to penetrate by further softening. As the goods continue to pass over the hot cans a gradual process of contraction takes place. This contraction is provided for by a corresponding regulation of the speed of the cans. Intermediate expansion pulleys are provided for this purpose, so that the speed adjustments can readily be made to meet the requirements of different kinds of web

The two pairs of front rubber nip rolls are likewise independently driven, so as to provide for the shrinkage which takes place at the steam box and size bath. At the delivery end of the machine the goods pass through a set of nip rolls which are belt driven from cone pulleys, so as to be able to deliver the goods at the speed they leave the last drying cans. From these last nip rolls, which are fixed quite high, they drop into receiving cans or boxes.

Ten to twenty-five strips running side by side are finished at one time. Adjustable guides are provided at different places on the machines to keep the goods running in proper position. The speed of the machine is usually governed by a Reeves transmission, and the delivery of the goods ranges from 10 to 15 yards per minute, according to the requirements of finishing. Three inches per yard is generally allowed for shrinkage, but this again is determined by the goods. Neglect at any point in this process may so interfere with the calculated shrinkage that values and costs are materially changed.

New patterns and grades should be tested for shrinkage as soon as the goods come from the loom, as short lengths made in sample looms are not at all times reliable. Frequent tests are also advisable to see that original conditions are maintained, as changes made by heat, steam and speed are always liable to occur.

The immersing process is used mostly for single cloth garter webs. Double cloth webs having a warp pile on the face are sized on the back only. Exceptions are made on double cloth white webs used for the corset trade, which are bathed with a very light size and often tinted in this bathing process to the desired tone of white to match the cloths they are to be associated with. Where the goods are sized on the back only the effect of this has to be considered when they are constructed, and provision made to maintain a proper balance under such conditions.

In frilled webs the elastic portion only is sized, so as not to interfere in any way with the soft flutings of the frill. This is done by guiding each strip over narrow pulleys which are run through the size bath. The size accumulated on these pulleys is absorbed by the web passing over them.

Acid in Goods

The requirements of the trade are so varied, and the types of web so numerous, that no formula for size is suitable for general use. Care must be taken, however, to avoid any sizes containing acids. Results from the use of such preparations may seem excellent at the machine but later on, when the goods are made up and come in contact with metal parts, the metal is quickly tarnished, and the result may be heavy claims for damage.

It may be well to note here that the sulphur used in the process of vulcanizing the rubber has the effect of blackening the copper cans and the rolls over which the goods must pass. This can be effectively prevented by

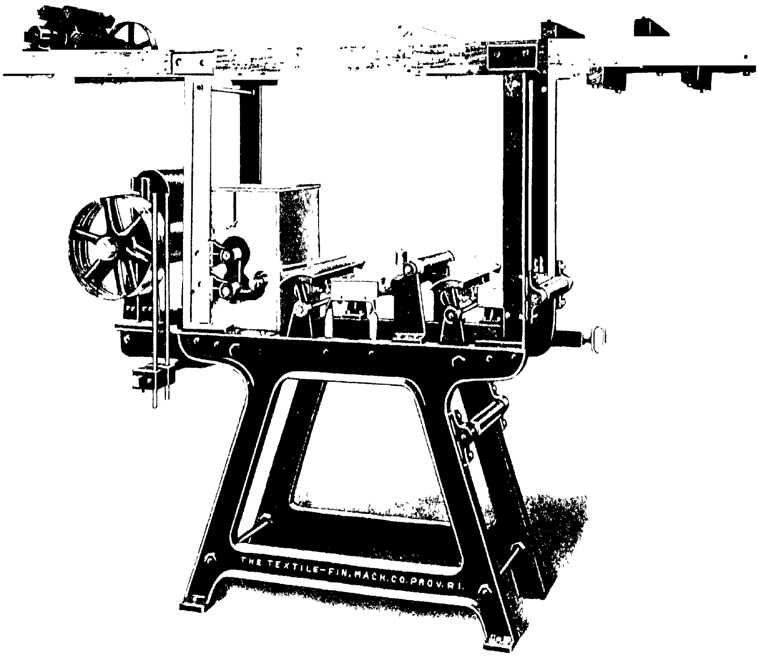


Fig. 1.—Narrow Fabric Singer

having the cans nickel plated, thus doing away with much risk of dirty goods, and of constant scourings and washing of the different parts.

Provision should be made for sufficient depth in the sizing pans so that they will hold a liberal supply of size. Replenishment should be made at regular intervals and the heat maintained at a uniform temperature to get satisfactory results. It is advisable to make provisions to travel the web over the top of the machine for a distance after immersion in the size bath, and before it strikes the hot cans, so as to allow for proper absorption of the size.

All these details are best worked out by experience. Webs are generally fed into the machine from racks after being properly wound up, and great care must be taken to avoid any variable tension on the webs when entering the machine.

On lisle webs, a process of gassing or singeing takes place prior to finishing for the purpose of removing any fuzz or fibre from the goods. Fig. 4 shows a gassing machine used for this purpose. It is run at a high rate of speed and several strips are gassed at once. When the machine is running the flames are close to the web, but upon the stopping of the machine the flames are carried away out of contact. In gassing white and colors, great care must be exercised to have the gas mixture correct and free from any carbonizing effect on the goods.

CHAPTER X.

Embossing Webs—Type of Construction and Design for Which Process is Adapted—Braiding Flat Elastic Fabrics, Plain Cords for Athletics and Airplanes, and Fancy Cords—How Sizes Are Indicated —Difference Between Woven and Braided Effects

THE embossing of elastic fabrics is a form of elaboration which is not adapted for long stretch webs.

It has been confined mostly to goods of short stretch, suitable for use in the manufacture of suspenders. In long stretch webs the patterns will not stand out prominently for any length of time. After repeated stretchings and wear, they lose much of the desirable sharpness of detail, and become flat and indistinct. Twills and loose weaves of a similar character should be avoided for embossing. The best results are obtained on firm, closely woven plain webs which take the impress of the design with clearness and retain it for a greater length of time.

DESIGNS SUITABLE FOR EMBOSSING

In planning such work it is well to avoid designs which run for any great length with the warp, and to select effects where the general run of the design is at an angle to the direction of the warp threads, rather than with them. This will prolong the life of the figure.

The process is similar to that used in embossing paper and leatheroid goods. The machine must be heavy and made to stand considerable pressure. It should be run slowly so as to allow the goods to get sufficient heat while in contact with the embossing roll. The webs should pass through a steam softening process just ahead of the embossing. This steaming is done by having a perforated steam pipe confined in a covered box, the web passing through slots at either side. It puts the goods in condition to receive and retain the impress of the figure.

EMBOSSING MACHINE

Figs. 1 and 2 show a machine used for embossing elastic fabrics. It consists chiefly of a heavy frame A, a case hardened steel roll B on which the design has previously been engraved, and a hard paper roll C. The engraved steel roll B is heated with steam and may be subjected to heavy pressure by turning the hand wheels D.

When putting in a new design and accompanying paper roll, it is necessary to run the machine empty for a few hours, gradually applying the pressure at the hand wheels in order to mesh the design into the paper roll so as to get a strong impress on the goods. When moire antique or water effects are desired, the embossing rolls are engraved with straight lines of the desired distance apart, and the goods are fed into the machine after passing over irregularly formed rollers, which prevent them from going through the machine straight. Fig 3 is an example of this effect, with the gros grain in the middle water-marked, and bordered with a fancy effect not embossed.

BRAIDING ELASTIC FABRICS

The braiding of elastic fabrics is a simple process when compared with weaving. It does not lend itself to any great variety of fancy effects, but a great variety of elastic goods are braided, which serve many purposes. Round cords are made in sizes from a single strand of rubber thread, such as is used for the protection of eye glasses, to the covering of multiple

rubber threads for making a cord which may be one inch or more in diameter. Some of these cords are used by professional athletes in acrobatic work. Large quantities of heavy cord are now used for shock absorbers in the manufacture of airplanes, and they are much used for corset laces and doll cords.

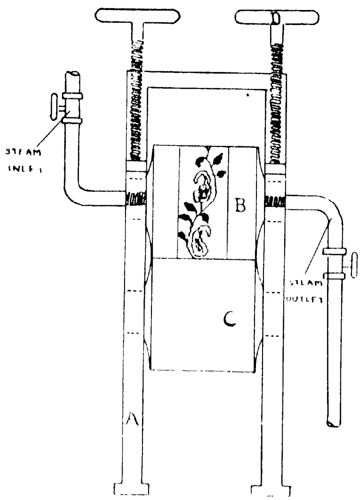


Fig. 1.—Embossing Machine

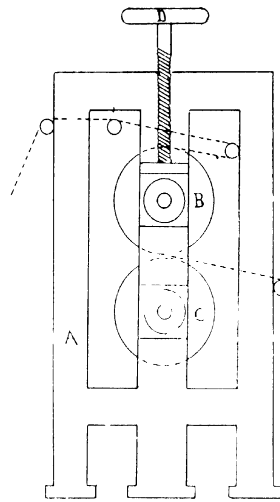


Fig. 2.—End View

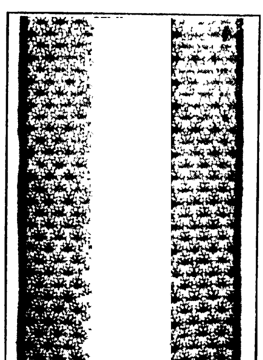


Fig. 3.—Embossed Water-Marked Effect on Middle Stripe

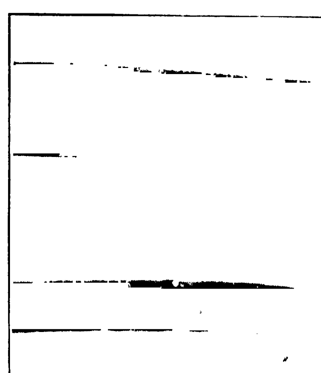


Fig. 4.—At Top, Cord Used by Acrobats. At Bottom, Exercise Cord in Two Colors

The braiding machines are small and compact, and are generally operated in gangs on benches. One operator can care for many machines, as they stop automatically when a thread breaks. Each machine may consist of a variable number of spool carriers, according to the character of the work they are engaged on. Carriers are made to travel around

Chapter XI.

WEAVING THE VAN HEUSEN COLLAR

Heavy Loom Required—How Long-Sided Effect and Folding Line Are Obtained—Cloth Construction

UNTIL recently the soft collar was cut and carved into shape from plain piece goods. The patented Van Heusen collar has done away with much of this, for from the loom is produced a fabric properly shaped and formed for the purpose, and ready to be cut into suitable lengths. It is adapted to various styles. Clumsy joinings are done away with and a collar is produced which combines shape, comfort and appearance. Much labor in collar manufacturing is also eliminated by this method of production.

There have recently been quite a number of factories put on the production of these goods, and at least one newly organized factory is devoted exclusively to their manufacture. The main feature in the Van Heusen collar is that it is woven in such a manner that when it leaves the loom it is complete in respect of the cloth for the band and outer part, with provision made for folding, thus doing away with any joining together of the two parts as formerly.

The formation of a cloth having the novel quality of allowing for a greater woven length at the outer edge of the collar than at the band, properly graded throughout so as to meet all the requirements of a collar in comfort and fit, at the same time providing for the insertion of the scarf so that it will run easily, and also allowing for the production of a variety of styles, calls for features in manufacturing that are different in many respects from the making of a flat fabric.

Heavy Loom Required

The first essential is a loom of sufficient strength and firmness to withstand the heavy beat of the lay resulting from packing in the filling, where an aggregate weight of 1,000 pounds for each individual piece must be carried. The looms which are now being used have from 12 to 16 pieces, so that it will be seen that they must be very rigid indeed properly to care for the weight carried on the combined pieces, and maintain uniform picking. In order also to get the requisite shed opening, the strain on the cams and cam jacks is severe, so that provision for ample strength at these parts is essential.

Cone-Shaped Take-Up Roll

The long-sided formation of the cloth is produced by the use of a cone-shaped take-up roll, as shown in the illustration, which has a slope of 1 inch in 6 inches. Above this cone-shaped roll is hung a straight roll, which swings freely to different angles, so as to take care of the slack delivered to the take-up roll. It will be noticed that one leg of the swinging roll is longer than the other, thus allowing the straight roll to set in proper position over the cone.

At first thought it would seem advisable to provide a reverse cone shaped take-up roll, as shown in the illustration, which has a slope of 1 the impracticability of such an arrangement and the straight roll with a free movement as described is more desirable. It is also necessary, or at least advisable, to use a slightly tapered roll on the breast beam, over which the cloth passes.

WOVEN IN THREE WIDTHS

The fabric woven is made in three widths, 4¼ inches, 4¾ inches and 5¼ inches, with the folding line in different positions in each width, so as to provide for different styles. The great amount of stock employed over these widths, and the difference in the take-up between one side of the web and the other, makes it necessary to divide the warps into sections and carry considerable weight on each, so as to obtain a perfect clearance in the shed, and pack the filling in uniformly.

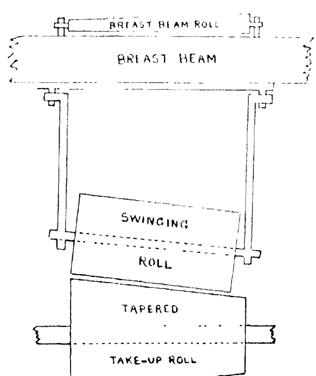
THE WEAVE

The weave employed is an ordinary double cloth plain, made with face, back, binder and gut. It is necessary to have 2 back, 2 binder, 4 face and 4 gut warps. The accompanying table will show the number of threads required in each warp, together with the weights carried on each one.

WARP DETAILS FOR VAN HEUSEN COLLAR

	4¼ Inch			4¾ Inch		5¼ Inch	
	No of Warps	Threads (60/2)	Weight Carried	No of Warps	Threads (60/2)	No of Warps	Threads (60/2)
Face	2	99	8 lbs each	2	109	2	119
Face	2	82	7 lbs each	2	92	2	104
Back	1	198	13 lbs each	1	218	2	238
Back	1	164	12 lbs each	1	184	2	208
Binder	1	99	10 lbs each	1	109	1	119
Binder	1	78	7 lbs each	1	88	1	100
Gut	2	99	8 lbs each	2	109	2	119
Gut	2	78	7 lbs each	2	88	2	100

It is essential that these warps be properly separated at the back rolls; Use the first roll for two binder, second for 4 face, third for 2 back and fourth for 4 gut. A 24 dent back reed should be used, which will allow for 4 face, 4 gut, 2 back and 2 binders in each dent, which together



Take-Up Giving Long-Sided Cloth

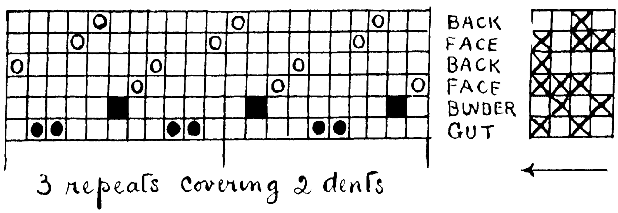
with the back roll separation of the different warps makes it convenient to handle the various warp sections and keep the threads straight and confined to the limitations of space available.

METHOD OF REEDING

The front reed used is a 40 dent, with one cord or seven threads to each dent. In some mills, however, great advantage has been found in using a 26½ dent front reed, drawing 10 threads in one dent and 11 in

the next, splitting between face and back, which makes the stock work much easier, and relatively increases the output. Any tendency to "rowing" caused by the dents in this coarser reed are completely hidden in the bleaching process.

The folding line between the neck band and the outer fold of the collar is made by leaving out the binder and gut threads in four cords at the desired point, only retaining the face and back threads. The position



Harness Draft and Weave for Van Heusen Collar

of the folding line may be varied in each of the three standard widths to meet the requirements of the manufacturer and according to the style of the collar desired.

There are 104 picks per inch, counting at the folded line, as there are more on the short side and less on the long side High grade 60/2 C. P. yarn is used throughout. The goods are woven in the gray and bleached afterwards.

Knitted Narrow Fabrics

By William Davis, M.A.

Branch of the Knitting Industry That Presents Interesting Features—Yarn Testing—Manufacture of Cleaners and Meat Bags, Coverings for Wires and Cables, Fancy Stitch and Colored Effects for Trimmings—Use of Core Thread to Give Strength

KNITTING machine builders are remarkable for the new inventions and adaptations they are constantly bringing out on their machines. Several important concerns in this line have recently been active in producing types to deal with the large trade now being done in narrow fabrics for various purposes.

The ordinary circular knitting machine of small diameter has long been recognized as a suitable means of making trials of new yarns to judge how closely they match the original sample, because in knitting there is not the necessity of elaborate warp preparation and loom mounting. The machine generally employed for this purpose is an ordinary type of stocking knitter containing 96 or 112 needles. If the machine is only to be employed as a sampling machine it is by no means necessary to have a full stocking machine, because in this work it is never necessary to use the ribber or dial which is always supplied.

The work of sampling to shade is done in most weaving or spinning factories and a narrow width plain stitch knitting machine is satisfactory for the purpose. It is usually quite suitable to work the machine by hand, owing to the small lengths required and the frequent changes necessary when testing different colors and qualities.

The latch needle machine is much better for this purpose than the bearded needle frame owing to the simplicity of loop formation and also owing to the facility with which small or thick yarns can be made to give good work on the machine with suitable adjustment of the stitch tensions. It is also used as a means of producing samples of color, as the various colors can be introduced rapidly one after the other on this machine.

This type of frame with the needles stationary, and revolving cams and thread guide has from the first been recognized as the best adapted for knitting gas mantles from ramie. The yarn is working in long lengths on a narrow width circular knitting machine using the latch needle and this fabric is afterwards cut into lengths according to the mantles being produced. Mantles of different sizes can be obtained by using different diameters of machines as supplied by machine builders for this purpose.

In most hardware establishments and department stores one sees woven metal material knitted into fabric on such machines, and intended to be used for cleaning pots and pans in household work. The wire has a sharp edge so as to grip the matter to be removed. Knitting the metal material into looped form enables the product to do its work with the greatest efficiency.

Another side line of the knitting industry is the production of what are known as meat bags, with which the carcasses of frozen and ordinary mutton and beef are covered prior to transport. These bags are usually

made on circular knitting machines of large diameter using the latch needle, and as the size of the yarn is fine compared to the set of the needles a gauze-like character is obtained which allows free circulation of air as well as affording a clean method of handling the meat and protecting it in the course of transport on ship, train and truck

Plain Knitted Tube

Examples are given by the accompanying illustrations of a few products of the narrow fabric branch of the trade. It will be evident at once what an interesting field of application is afforded by this division of the knitting industry. Fig. 1 shows a plain knitted fabric worked in circular form on a knitting machine using the latch needle in which we have 40 needles in the circumference, so that in this tube, front and back, are 40 stitches shown here in flat form.

It is evident that this tubing can be used for the purpose of covering wires and cables which slide inside the fabric. It has more elasticity than woven fabric of similar form and is generally produced in a more simple and direct manner. It should be pointed out, however, that this fabric is susceptible to being torn and if it breaks at any point a little further strain

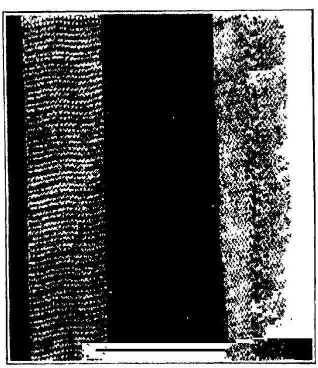


Fig. 1 Fig. 2

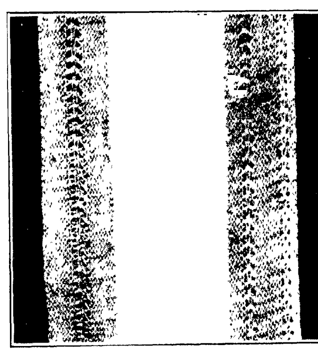


Fig. 3 Fig. 4

will cause it to unravel in a rapid manner. Thus it is clear that it cannot be used by itself to any great extent in cases where great strain or pull will be applied to it Made in suitable materials, there is nothing to hinder this tube from serving as lamp wicks.

Introduction of Fancy Stitch

Fig. 2 shows the same fabric with a fancy stitch introduced at one needle on the cylinder of the knitting machine to produce what is known as "tuck" work. In this work the needle in question is made to hold its thread for one course without knocking over its loop, and takes a second thread on the next course so that two threads are knocked over together, giving rise to the effect shown in the middle of the illustration.

This effect is produced by inserting a needle at this point with a latch which is longer than the other needle latches of the machine, with the result that it does not knock over its stitches with the ordinary needles unless it receives a specially deep draw down, which it gets every second course. All

the stitches made on this needle are double as compared with the single stitches in the rest of the tube In a machine with 20 needles in the circumference, one needle would be inserted with this extra long latch to give a tuck stitch right down the tube

As regards the position of the fabric at which the tuck effect is made to show, this is entirely a matter of arrangement in folding the tube According to the line of folding the tuck effect can be made to appear in the middle or at the side

Further examples of this style of narrow fabric are given in Figs 3 and 4, made on the same diameter of machine In Fig 3 the tuck stitch is made both front and back of the tape, that is, a long latch needle is inserted in the cylinder every tenth needle so that there are two in the circumference in place of the single line in Fig 2 In Fig 3 the second vertical line of tucking stitches appears on the back of the fabric directly under the line shown on the face, and this has the effect of making the tuck stitch more pronounced

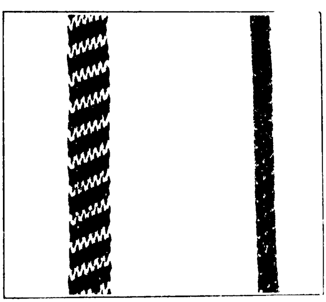


Fig. 5 Fig 6

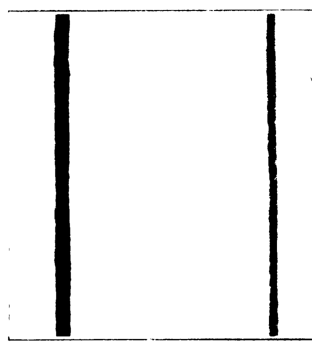


Fig 7 Fig. 8

In Fig 4 it will be recognized that this idea is further developed by having two vertical rows of tuck stitches showing on the face of the tube, and these are supplemented by two others placed directly under them on the other side of the fabric, thus giving a total of four long latch needles in the circumference of the machine To give the proper effect, the tube as obtained from the machine has to be carefully pressed so as to show the fancy effect at the correct place, for if the tube gets out of alignment at any point, this will affect the form of the pattern

Use for Trimmings

In the knitting industry such pieces of tubing folded double are found extremely useful in trimming garments, particularly in the circular or cut trade, where so much depends on having articles tastefully ornamented at a moderate cost. At present the manufacturer has often to buy these touches of trimmings from the outside. The great advantage of doing the work on his own premises and on his own machines is that he can install such a machine at a very moderate cost and place among his ordinary knitting machines at little or no extra cost for mechanics.

Patterns With Colored Yarns

Several other examples are given herewith of the application of this principle of the latch needle knitting machine for tubular fabrics suitable for narrow tapes or ribbons. Fig. 5 illustrates a fabric produced on a machine of still narrower dimensions, having only 12 needles in the circumference of the machine. In this case the pattern effect is introduced by having several feeds of thread in the circumference; three different colors are employed and introduced in the order of one white, one black, and one tan all the way down the fabric, thus giving rise to a style of pattern which is very suitable for many purposes of the knitting manufacturer, particularly of outer garments. There are three yarn feeds round the circumference of this machine and every revolution of the machine creates three courses in the three colors named.

It will be noted that this gives rise to a color effect showing at a decided angle to the right, in place of being exactly horizontal, as would be approximately the case in a machine of larger diameter. This is one of the defects of all machines of this character where several feeds are used. They create a decidedly spiral tendency and the color effects appear at an angle. In many cases this is no disadvantage, but rather the reverse, as it takes away the stiffness of the color scheme and produces attractive effects in twill fashion similar to what can only be created in woven goods by the aid of the corkscrew weave and an elaborate setting of the cloth.

Fabrics of the character shown in Fig. 5 are very useful for edging parts of knitting coats, jumpers or vestings, these edgings giving a suitable finish for the edges of the garment. In addition to the color feature, these bands are often made in a tight tension so as to give a rigid cloth which will strengthen certain parts at which extra pull is applied, enabling the garment to retain its shape.

Knitted Cords

Fig. 6 gives a view of a narrow fabric made on a circular latch needle knitting machine with only six needles in the cylinder. There are two feeds, one supplying blue yarn to the needles and the other supplying green, the pattern being alternate courses of green and blue. The material is artificial silk and the cord, for it is nothing more, is employed for threading through certain garments which have a kind of open trimming through the spaces of which this cord is passed to complete the drawing together of the part. Very often these drawing together cords are provided with tassels at their extreme ends to afford a further ornamental feature.

Fig. 7 gives another variation of this pattern produced on the same machine where the courses alternate with each other in red and green. This sample shows the facility with which new color blends can be produced to match any color of ground garment. One bobbin is simply replaced with another on the machine, or both may be changed. In this pattern again a decided tendency is shown for the effect to run in the direction of the right owing to the tendency to a spiral effect.

Use of Core Thread

In some cases the cord made of the knitted fabric itself is too elastic and lacks the tensile strength required for certain purposes. In this event it is an easy matter to arrange that a center core thread be run into the machine as the fabric is being knitted. The core thread is made of some strong, non-elastic material and is arranged on a bobbin above the machine. That material is drawn off its bobbin and passes down the center of the

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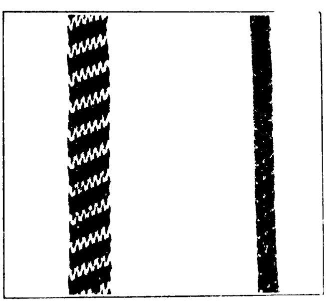

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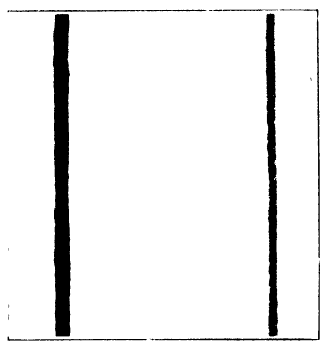

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